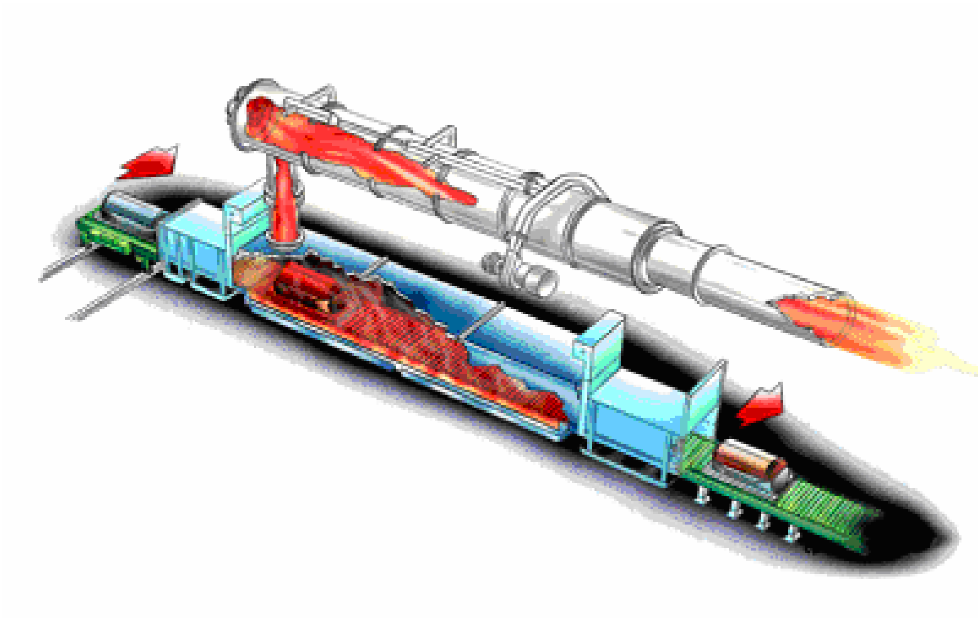
TOOELE CHEMICAL AGENT DISPOSAL FACILITY (TOCDF)



MUSTARD AGENT TON CONTAINER TRIAL BURN PLAN

FOR THE

METAL PARTS FURNACE

(Fulfilling Requirements of the RCRA, Title V, and MACT Regulations)

Revision 1

April 7, 2006

EG&G
A Division of URS

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EXECUTIVE SUMMARY

The Tooele Chemical Agent Disposal Facility (TOCDF) was designed and built for the U.S. Army to destroy the chemical agent munitions stockpile at the Deseret Chemical Depot (DCD), located 20 miles south of Tooele, Utah. EG&G Defense Materials, Inc., (EG&G) operates the TOCDF under contract to the Army through the Chemical Materials Agency (CMA).

The U.S. Environmental Protection Agency (EPA) identification number for the TOCDF is UT5210090002. The facility operates under a Resource Conservation and Recovery Act (RCRA) Part B permit, issued pursuant to the delegation of the State of Utah, Department of Environmental Quality (DEQ), Division of Solid and Hazardous Waste (DSHW), under the Utah Administrative Code, Section 315 (R315). The TOCDF also operates under a Title V air permit administrated by the State of Utah, DEQ, Division of Air Quality (DAQ). Under these permit requirements, the incinerator system must demonstrate the ability to effectively treat any hazardous wastes such that human health and the environment are protected.

This plan addresses the conduct of an Agent Trial Burn (ATB) in the Metal Parts Furnace (MPF) to fulfill the trial burn requirements of the RCRA permit for mustard (H series) agent processing using distilled mustard agent (HD) in ton containers (TCs). The ATB will also generate the data required to update the DCD Human Health Risk Assessment (HHRA). The data needs for these requirements will be met by collecting a complete set of samples that will characterize the emissions from the MPF. This ATB will also provide the data necessary to meet the needs of a Comprehensive Performance Test (CPT), thereby fulfilling the requirements of the Title V air permit; however, these will both be referred to as the ATB in this document. In addition, a complete set of process data will be collected to document the performance of the MPF under the test conditions. EG&G will conduct the ATB, and a subcontractor will conduct sampling and analysis of the incinerator effluent streams.

The TOCDF MPF TC Mustard (HD) ATB will consist of two test conditions. One condition will use liquid mustard heels in TCs to demonstrate a maximum agent feed rate at minimum temperatures in the MPF Primary Combustion Chamber (PCC) and Afterburner (AFB). The second condition will use TCs with solid heels covered with liquid mustard to demonstrate the processing of the solid residues in the TCs.

The trial burn objectives include demonstrating that:

- The MPF achieves a minimum Destruction and Removal Efficiency (DRE) for mustard agent that exceeds 99.99 %.
- The MPF operating conditions meet the RCRA, Title V, and MACT regulations.
- Emissions are below limits set in the facility's RCRA permit and Title V air permit.

- The particulate matter, sulfur dioxide, and carbon monoxide Comply with the Title V permit requirement on a five year interval.

- Emission rates of Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), and metals are consistent with values used in the DCD HHRA.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAO	Air Approval Order
ACAMS	Automatic Continuous Air Monitoring System
ACS	Agent Collection System
ADAFC	ACAMS Dilution Air Flow Controller
AFB	Afterburner
ATB	Agent Trial Burn
AWFCO	Automatic Waste Feed Cutoff
Brine	Wet Scrubber Recirculation Brine
CAL	Chemical Assessment Laboratory
CEMS	Continuous Emission Monitoring System
CFR	Code of Federal Regulations
CHB	Container Handling Building
CMA	Chemical Materials Agency
CPT	Comprehensive Performance Test
CWC	Chemical Weapons Convention
DAAMS	Depot Area Air Monitoring System
DAQ	State of Utah Department of Environmental Quality, Division of Air Quality
DCD	Deseret Chemical Depot
DDAFC	DAAMS Dilution Air Flow Controller
DEQ	State of Utah Department of Environmental Quality
DFS	Deactivation Furnace System
DRE	Destruction and Removal Efficiency
DSHW	State of Utah Department of Environmental Quality, Division of Solid and Hazardous Waste
EG&G	EG&G Defense Materials, Inc.
EPA	U.S. Environmental Protection Agency
ETL	Extreme Temperature Limit
FCC	Facility Construction Certification
FSSS	Flame Safety Shutdown System
GC	Gas Chromatography
GC/FID	Gas Chromatograph/Flame Ionization Detector
GC/FPD	Gas Chromatograph/Flame Photometric Detector
GC/MS	Gas Chromatograph/Mass Spectrometer

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

H	Levinstein Mustard
HD	Distilled Mustard
HT	Mixture *bis*(2-chloroethyl)sulfide and *bis*[2-(2-chloroethylthio)ethyl] ether
HEPA	High Efficiency Particulate Air
HHRA	Human Health Risk Assessment
HWC	Hazardous Waste Combustors
ID	Induced Draft
HRA	Hourly Rolling Average
JACADS	Johnston Atoll Chemical Agent Disposal System
LCO	Limiting Condition of Operation
LIC	Liquid Incinerator
LOP	Laboratory Operating Procedure
LOQ	Limit of Quantitation
MACT	Maximum Achievable Control Technology
MDB	Munitions Demilitarization Building
MDL	Method Detection Limit
MEB	Mass and Energy Balance
MPF	Metal Parts Furnace
MRE	Metals Removal Efficiency
NC	Not Calculated
NE	Not Evaluated
NOI	Notice of Intent
NDIR	Non-Dispersive Infrared
NVTOC	Non-Volatile Total Organic Compounds
ONC	On-Site Container
PAS	Pollution Abatement System
PCC	Primary Combustion Chamber
PDARS	Process Data Acquisition and Recording System
PIC	Products of Incomplete Combustion
P&ID	Piping and Instrument Diagram
PLC	Programmable Logic Controller
PM	Particulate Matter
POHC	Principal Organic Hazardous Constituent
PQL	Practical Quantitation Limit
PST	Performance Specification Test
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QP	Quality Plant Sample

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

R315	Utah Administrative Code Section 315
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SCW	Secondary Cooling Water
SEL	Source Emission Limit
SMVOC	Sampling Method for Volatile Organic Compounds
STEL	Short Term Exposure Limit
SVOC	Semi-Volatile Organic Compound
SVTOC	Semi-Volatile Total Organic Compounds
SW-846	Test Methods for Evaluating Solid Waste, 3rd Edition including Update III, USEPA, SW-846, December 1996.
TC	Ton Container
TCLP	Toxicity Characteristic Leaching Procedure
TE-LOP	Tooele Laboratory Operating Procedure
TEQ	Toxic Equivalent Concentration
THC	Total Hydrocarbons
TOC	Total Organic Compounds
TOCDF	Tooele Chemical Agent Disposal Facility
TSCA	Toxic Substance Control Act
UPS	Uninterruptible Power Supply
VOC	Volatile Organic Compound
VTOC	Volatile Total Organic Compounds
WAP	Waste Analysis Plan

LIST OF UNITS OF MEASURE

acfm	actual cubic feet per minute
Btu/hr	British thermal units per hour
Btu/lb	British thermal units per pound
cfm	cubic feet per minute
°C	degree centigrade
°F	degree Fahrenheit
dscf	dry standard cubic feet
dscfm	dry standard cubic feet per minute
dscm	dry standard cubic meter
ft	foot
ft^3	cubic feet
g	gram
g/sec	grams per second
gpm	gallons per minute
hr	hour
hp	horsepower
inWC	inches of water column
lb	pound
lb/hr	pounds per hour
L/min	liters per minute
µg	microgram
m^3	cubic meter
mg	milligram
mg/dscm	milligram per dry standard cubic meter
min	minute
mL	milliliter
mL/min	milliliters per minute
mm	millimeter
ng	nanogram
ppm	parts per million
ppmdv	parts per million on a dry volume basis
psig	pounds per square inch gauge
scfm	standard cubic feet per minute
Wt%	weight percent
ΔP	velocity pressure

LIST OF CHEMICAL SYMBOLS AND FORMULAS

Al	aluminum
Ag	silver
As	arsenic
As_2O_3	arsenic oxide
B	boron
Ba	barium
Be	beryllium
Cd	cadmium
CdO	cadmium oxide
Cl^-	chloride
Cl_2	chlorine
CO_2	carbon dioxide
CO	carbon monoxide
Co	cobalt
Cr	chromium
Cu	copper
HD	distilled mustard
HF	hydrogen fluoride
HNO_3	nitric acid
H_3PO_4	phosphoric acid
Hg	mercury
HCl	hydrogen chloride
Mn	manganese
NaOH	sodium hydroxide
H_2SO_4	sulfuric acid
mustard	*bis*(2-chloroethyl)sulfide
Ni	nickel
NO_x	nitrogen oxides
O_2	oxygen

LIST OF CHEMICAL SYMBOLS AND FORMULAS (continued)

Pb	lead
PbO	lead oxide
PbCl	lead chloride
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofurans
Q	1,2-*bis*(2-chloroethylthio)ethane
Sb	antimony
Se	selenium
SO_2	sulfur dioxide
Sn	tin
T	*bis*[2-(2-chloroethythylthio)ethyl]ether
TCDD	tetrachlorodibenzo-p-dioxins
Tl	thallium
V	vanadium
Zn	zinc

LIST OF IDENTIFICATION CODES FOR MPF INSTRUMENTS THAT MONITOR REGULATED OPERATING PARAMETERS

14-TIT-152 [a]	PCC Temperature Zone 1
14-TIT-141 [a]	PCC Temperature Zone 2
14-TIT-153 [a]	PCC Temperature Zone 3
14-PIT-070 [b]	PCC Pressure
14-PSHH-034 [a]	PCC Pressure High-High
14-TIT-010 [b]	PCC Exhaust Gas Temperature
14-TIT-065 [a]	Afterburner Exhaust Gas Temperature
24-FIT-9667 [a]	Exhaust Gas Flow Rate
24-TIT-509 [b]	Quench Tower Exhaust Gas Temperature
24-TSHH-223 [c]	Quench Tower Exhaust Gas Temperature High-High
24-PDIT-222 [a]	Venturi Scrubber Differential Pressure
24-FIT-218 [a]	Quench Brine To Venturi Scrubber Flow Rate
24-PIT-233 [c]	Quench Brine Pressure
24-FIT-248 [a]	Clean Liquor to Scrubber Tower Sprays Flow
24-PIT-258 [c]	Clean Liquor Delivery Pressure
24-DIT-216 [a]	Quench Brine Density
24-AIT-224 [a]	Quench Brine pH
14-AIT-384 [a]	Exhaust Gas CO, 60-min rolling average corrected to 7 % O_2
24-AIT-669 [a]	Exhaust Gas CO, 60-min rolling average corrected to 7 % O_2
14-AIT-082 [c]	Exhaust Gas O_2
24-AIT-670 [c]	Exhaust Gas O_2
24-AIT-247 [d]	Clean Liquor pH
24-DIT-249 [d]	Clean Liquor Density
24-PDIT-225 [d]	Pack Bed Scrubber Differential Pressure
24-PIT-9667 [b]	V-Cone Pressure
24-TIT-9667 [b]	V-Cone Temperature
49-WIT-152 [b]	Load Cell, BDS-101
49-WIT-252 [b]	Load Cell, BDS-102

[a] Required by TOCDF RCRA Permit and HWC MACT Regulations
[b] Non-Regulated Instrument
[c] Required by TOCDF RCRA Permit
[d] Required by HWC MACT Regulations

1.0 INTRODUCTION

The Tooele Chemical Agent Disposal Facility (TOCDF), a hazardous waste incineration facility, was designed and built for the U.S. Army for the destruction of the chemical agent munitions stockpile at the Deseret Chemical Depot (DCD), located 20 miles south of Tooele, Utah. The TOCDF is designed to thermally treat chemical Agents GB, VX, and mustard (H-series), drained munitions, contaminated refuse, bulk containers, liquid wastes, explosives, and propellants. EG&G Defense Materials, Inc., (EG&G) operates the TOCDF under contract to the U.S. Army through the office of the Chemical Materials Agency (CMA).

The U.S. Environmental Protection Agency (EPA) identification number for the TOCDF is UT5210090002. The facility operates under a Resource Conservation and Recovery Act (RCRA) Part B permit, issued pursuant to the delegation of the State of Utah, Department of Environmental Quality (DEQ), Division of Solid and Hazardous Waste (DSHW), under the Utah Administrative Code, Section 315 (R315). The TOCDF also operates under a Title V air permit administrated by the State of Utah, DEQ, Division of Air Quality (DAQ). These permits require that the incinerator system demonstrate an ability to effectively treat any hazardous waste such that human health and the environment are protected by conducting trial burns to meet the RCRA requirements and a Comprehensive Performance Test (CPT) to meet the Title V and Hazardous Waste Combustors (HWC) Maximum Achievable Control Technology (MACT) requirements. This trial burn will also satisfy the Title V requirement to test the MPF air emissions for particulate matter (PM), sulfur dioxide (SO_2), and carbon monoxide (CO) every five years.

The TOCDF operates four incinerator systems to destroy of the chemical agents stored at DCD. These incinerators include the two Liquid Incinerators (LIC1 and LIC2), the Metal Parts Furnace (MPF), and the Deactivation Furnace System (DFS). Agent Trial Burns (ATBs) will be conducted in the MPF and LICs as the systems begin processing mustard agent. This plan will describe how TOCDF intends to use distilled mustard (HD) in ton containers (TCs) to conduct a combined ATB and CPT in the MPF, which will be referred to as the MPF TC HD ATB. The LIC ATB will be addressed in a separate ATB Plan. The DFS will operate under the permit conditions established by the VX ATB since measurable amounts of mustard will not be feed directly into the DFS during the TOCDF Mustard Campaign.

This ATB plan describes how TOCDF will:

- Demonstrate that HD can be destroyed in accordance with RCRA requirements found in Title 40, Code of Federal Regulations, Part 264, Paragraph 343 (40 CFR 264.343), and R315–8–15.

- Use sampling and analysis methods from Test Methods for Evaluating Solid Waste, 3rd Edition including Update III, USEPA, SW-846, December 1996 [SW-846 (1)], 40 CFR 60, Appendix A (2), and Tooele Laboratory Operating Procedures (TE-LOP) to demonstrate compliance with regulatory limits.

A separate Continuous Emission Monitoring System (CEMS) performance evaluation is conducted annually as directed in Attachment 20 to the TOCDF Permit (3). The MPF TC HD ATB Plan was developed using the EPA Guidance in the "Hazardous Waste Combustion Unit Permitting Manual" (4). In addition, this plan is submitted as a permit modification for the MPF. Regulatory reference citations are given, as appropriate, throughout the trial burn plan.

1.1 TRIAL BURN PLAN ORGANIZATION

This plan is a stand-alone document to allow a separate review from that of the RCRA permit modification. The plan describes the operating conditions for the testing and the samples to be collected as part of the MPF TC HD ATB. The Quality Assurance Project Plan (QAPP) (Appendix A) describes the sampling and analyses to be conducted. Appendix B provides the shakedown plan for the MPF. The Mass and Energy Balances (MEBs) for the MPF TC HD ATB are found in Appendix C. The Automatic Waste Feed Cutoffs (AWFCOs) are summarized in Appendix D. Appendix E contains the summary of the mustard agent characterizations. Appendix F contains Alternate Monitoring Requests to be used with the MPF during the Mustard Campaign. Appendix G contains an outline of the ATB Report, and referenced drawings for the MPF are in Appendix H.

This introduction provides an overview of the plan, including:

- Process descriptions;
- Waste feed descriptions;
- Trial burn objectives;
- Trial burn approach;
- Trial burn program;
- Trial burn protocol; and
- Expected final permit conditions resulting from the trial burn.

1.2 FACILITY INFORMATION

The TOCDF is located in EPA Region 8. The TOCDF EPA Identification Number is UT5210090002, which is also the DSHW permit number. The DCD Title V Operating Permit Number is 4500071001.

The MPF TC HD ATB points of contact are:

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1.3 WASTE TREATMENT SYSTEM PROCESS AND FEED DESCRIPTIONS

The various types of munitions and bulk items processed at TOCDF require the operation of different combinations of incinerators. Therefore, the TOCDF is designed to operate as an integrated plant with all incinerators capable of operating concurrently. Therefore, in addition to the MPF, the LICs will be operated to process the agent drained from the TCs used in the MPF TC HD ATB. During the trial burn, the LICs may be processing to make room to drain additional TCs.

This plan covers the MPF and the associated Pollution Abatement System (PAS). The descriptions of the waste handling and storage systems contained herein are provided as supplemental information to facilitate an understanding of their configuration relative to the rest of the waste treatment system. The MPF thermally decontaminates bulk containers and projectile casings and destroys any residual agent that remains after draining. The incineration process includes a Primary Combustion Chamber (PCC) followed by an Afterburner (AFB). Exhaust gas from the AFB is routed to the PAS, which includes a quench tower, a high-energy venturi scrubber, a low-energy packed bed scrubber, a demister, and an induced draft (ID) fan.

Brief descriptions of the major discrete components follow, and a detailed system description is provided in Section 2 of this plan. Appendix H contains the Overall Site Plan & Vicinity Map, Drawing #TE-16-C-2.

1.3.1 Waste Handling and Storage

The demilitarization process begins with transport of chemical munitions from their storage site at DCD Area 10 to the TOCDF for processing. Munitions and TCs are moved from Area 10 to the TOCDF Container Handling Building (CHB) in On-Site Containers (ONCs). The ONCs are temporarily stored in the CHB until they are moved into the Munitions Demilitarization Building (MDB) where the munitions and bulk storage containers are removed from the ONCs and then processed. The agent drained from the munitions and storage containers is pumped to one of the two Agent Collection System (ACS) tanks, which are vertical, carbon-steel tanks. Any residual agent in the munitions and storage containers is destroyed in the MPF during treatment of those items. Materials treated in the MPF will be handled as directed by the Waste Analysis Plan (WAP).

1.3.2 Combustion Process

The MPF was custom-designed by Wellman Furnaces, Inc., and given model designation S.O. 89-305. The PCC is a 41-ft-long by 6.6-ft-high (internal dimensions), refractory-lined chamber containing a roller hearth. The 10 burners are rated for a maximum total heat rate of 15.7 million British thermal units per hour (Btu/hr). Natural gas mixed with combustion air provides the fuel for the 10 burner nozzles in the PCC. The fuel mixture is burned to maintain the PCC between 1,150 °F and 1,800 °F. An ID fan draws the exhaust gases from the PCC through the refractory-lined crossover duct to the AFB.

The AFB is a horizontal, refractory-lined, cylindrical chamber that provides high temperature, residence time, and turbulent mixing to complete the thermal destruction of any mustard agent remaining in the PCC effluent. The AFB is 38 ft long and 4 ft in diameter (internal dimensions). Two burners in the AFB are fueled by natural gas mixed with combustion air and are rated at 8.5 million Btu/hr. The AFB controls exit gas temperature between 1,800 °F and 2,175 °F. A minimum 0.5-second residence time ensures complete destruction of any residual mustard agent in the AFB. The calculation of the residence time is shown in Appendix C.

1.3.3 Pollution Abatement System

The PAS is designed to remove acid gases, PM, and metals from the exhaust gas prior to discharge to the atmosphere. The PAS consists of a quench tower, high-energy venturi scrubber, packed bed scrubber, demister, and ID fan. Exhaust gases travel from the AFB to the quench tower, where they pass through a series of Wet Scrubber Recirculation Brine (Brine) sprays that cool the gases by evaporating water. The quench tower has an up-flow design with a diameter of 6 ft and a height of 40 ft. Under normal operating conditions, a liquid-to-gas ratio of 100 gallons per minute (gpm) to about 24,600 cubic feet per minute (cfm) is maintained. The quench tower was designed for a maximum inlet temperature of 2,175 °F and a maximum outlet temperature of 225 °F. Typical gas inlet and exit temperatures are 1,950 °F and 200 °F, respectively.

Exhaust gases pass from the quench tower through the high-energy venturi scrubber, where high-pressure Brine sprays create small droplets for efficient capture of small PM. Acid gases are absorbed by the Brine and neutralized by the caustic in the Brine. The venturi operates in the range of 20 to 40 inches of water column (inWC) when the system is processing agent. The exit from the venturi scrubber leads to a 90-degree, vertical-to-horizontal elbow in the ductwork. The high velocity of the exhaust gases combined with the change of direction in flow effectively removes the PM from the gases.

The scrubber tower is a Hastelloy® vessel, 5 ft 6 inches in diameter and 40 ft high. Effluent from the venturi scrubber enters the scrubber tower, where the liquid falls into the tower reservoir and the gas rises through the chimneys of the clean liquor tray. The clean liquor is controlled to a pH greater than (>) 7.0 by the addition of 18 % sodium hydroxide (NaOH). Exhaust gases are scrubbed by the clean liquor, which removes PM and neutralizes any remaining acid gases. The gases pass through a mist eliminator as they exit the scrubber tower.

The demister is a fiberglass vessel, 11 ft in diameter and 31 ft high. Gases flow through the demister candles, which remove entrained solids and liquid droplets. Solids are trapped on the candles, and liquids drain to the vessel bottom where they are pumped to the scrubber reservoir.

The ID fan, which is a two-stage blower with two fans in series, maintains the MPF and associated PAS under negative pressure to prevent fugitive emissions. The PCC is maintained typically at greater than 0.5 inWC vacuum relative to the MPF furnace room. An emergency ID fan will operate in the event that power to the system is lost.

1.3.4 Wet Scrubber Recirculation Brine Description

Acid gases generated during combustion are removed from the exhaust gases by the PAS. The Brine removes the acid gases and neutralizes the acidic compounds. The scrubber tower reservoir receives all Brine drainage from the PAS. Then, when the Brine density in the reservoir reaches the specific gravity setpoint, the Brine automatically discharges to one of four waste holding tanks for storage prior to off-site disposal. When the liquid volume in the reservoir dips below the established setpoint, process water is introduced to maintain the appropriate volume.

The Brine normally has a pH of ≥ 7.0. The Brine total dissolved solids are typically about (≈) 100,000 parts per million (ppm), and the total suspended solids are typically ≈ 800 ppm.

1.4 WASTES TO BE TREATED

The DCD stockpile to be destroyed at TOCDF originally contained munitions and bulk storage containers of Agents GB, VX, and H-series mustard. All Agents GB and VX intended for TOCDF processing were destroyed in previous campaigns. The provisions of the Chemical Weapons Convention (CWC) directs that mustard agent must also be destroyed; therefore, the residual mustard agent in the TCs must be treated so that it cannot be reused, is not marketable, and cannot be recovered economically. The destruction of mustard agent is addressed by this ATB plan and is further addressed by the permit modification associated with the plan.

The wastes to be treated during this trial burn are TCs (bulk storage containers) that contain liquid mustard agent with mercury concentration that are less than (<) 1 milligram/kilogram (mg/kg) and solid residues from the decomposition of mustard. The State of Utah has defined mustard agent as acutely hazardous and identified it as a P999 (i.e., chemical agent) material along with any waste contaminated with mustard. Residues from the treatment of P999 wastes are classified as F999 wastes including combustion residues because the residues are derived from RCRA wastes. However, TOCDF does not produce or handle any liquids containing polychlorinated biphenyls (PCBs) that would be regulated under the Toxic Substance Control Act (TSCA), or treat any waste materials with dioxin waste codes (i.e., F020, F021, F022, F023, F026, or F027).

The MPF provides the most economical and safest method of metal container decontamination. Metal items, munitions, and bulk containers that have heels are treated semi-continuously in the MPF. In addition, the MPF thermally-decontaminated metal containers carry the State of Utah waste code F999 (for wastes resulting from the treatment of chemical agent), pending future evaluation there will be other waste codes applied to the specific munition or item treated.

The TCs contain a combination of liquid mustard agent from DCD HD TCs and solids formed by the decomposition of *bis*(2-chloroethyl)sulfide. The average composition of the liquid mustard agent is shown in Table 1-1, which summarizes data from the Mustard Characterization Report in Appendix E for those TCs with low mercury concentrations (data for TCs with mercury concentrations > 1 mg/kg were excluded from the data in Table 1-1). The solids are composed of mustard and S-(2-chloroethyl)dithianium chloride, which is an ionic organic compound that is not soluble in *bis*(2-chloroethyl)sulfide. The solids contain varying concentrations of metals, which are summarized in Table 1-2 for those TCs with low mercury concentrations in the liquid mustard (data for TCs with mercury concentrations > 1 mg/kg were excluded from the data in Table 1-2). This table shows the range of concentrations for the 20 metals using data from Appendix E. Data from Appendix E indicates that the solids have an average ash content of 22.5 weight percent (Wt%), chlorine content of 31.5 Wt%, and a higher heating value of 9,600 British thermal units per pound (Btu/lb).

TABLE 1-1. LIQUID MUSTARD CHARACTERIZATION SUMMARY

Parameter	Average	Maximum Value	Minimum Value
Organic Compounds			
Bis(2-Chloroethyl)sulfide (Wt%)	89.31	101	78.7
Thiodigylcol (Wt%)	0.026 U	0.029 U	0.0218 U
1,2-Dichloroethane (Wt%)	0.606	0.993	0.197
Tetrachloroethene (Wt%)	0.050	0.0734	0.0127 J
1,1,2,2-Tetrachloroethane (Wt%)	0.052 U	0.0588 U	0.0472 J
bis [2-(2-chloroethylthio)ethyl] ether (T) (Wt%)	0.17	0.355	0.0409 J
1,2-*bis* (2-chloroethylthio)ethane (Q) (Wt%)	3.24	5.66	0.448
Hexachloroethane (Wt%)	0.21	0.293 U	0.0245 J
Lewisite (mg/kg)	5.24	14.5	2.82 J
1,4-Dithiane (Wt%) [TIC]	1.10	5.6	0.028
1,4-Thioxane (Wt%) [TIC]	0.26	0.97	0.083
2-Chloroethyl 4-chlorobutyl sulfide (Wt%) [TIC]	0.51	3.0	0.079
Bis(2-Chloropropyl)sulfide (Wt%) [TIC]	0.19	1.0	0.043
Element (mg/kg)			
Aluminum	38 U	55 U	12 J
Antimony	5.09 U	5.5 U	0.67 J
Arsenic	5.80	51.6	1.3 J
Barium	5.08 U	5.5 U	0.44 J
Beryllium	5.19 U	5.5 U	4.8 U
Boron	9.34 U	11 U	4.0 J
Cadmium	5.19 U	5.5 U	4.8 U
Chromium	4.81	29.9	1.4 J
Cobalt	1.03 U	1.1 U	0.33 J
Copper	37.9	84.8	4.5 J
Lead	4.71 U	5.5 U	0.47 J
Manganese	1.67	6.49	0.33 J
Mercury	0.35 U	0.55 U	0.054 J
Nickel	3.40	15.7	0.36 J
Selenium	10.1 U	11 U	1.2 J
Silver	5.15 U	5.5 U	1.72 J
Thallium	5.19 U	5.5 U	4.8 U
Tin	10.4 U	11 U	9.54 U
Vanadium	3.12 U	5.5 U	1.06 J
Zinc	9.76	29.4	3.42 J

Notes:

This data includes TCs with liquid mustard mercury concentrations < 1 mg/kg.

TIC indicates that these compound was identified as a Tentatively Identified Compound by GC/MS analysis.

U indicates that none of the values exceeded the PQL.

J indicates that the value was estimated because the value was between the MDL and PQL.

TABLE 1-2. MUSTARD SOLID HEELS CHARACTERIZATION SUMMARY

Element	Average (mg/kg)	Standard Deviation	Maximum Value (mg/kg)	Minimum Value (mg/kg)
Aluminum	36.4	22.1	160	10.8 J
Antimony	2.04	3.57	30.3	0.179 J
Arsenic	171	375	1850	0.935 J
Barium	1.40	2.21	14.2	0.0467 J
Beryllium	4.9 U	0.86	5.56 U	0.0572 J
Boron	9.6 U	1.6	11.1 U	3.99 J
Cadmium	0.941 U	1.60	5.34 U	0.0736 J
Chromium	45.9	56.6	397	9.28
Cobalt	7.37	5.15	27.1	2.13
Copper	158	282	2350	4.13
Lead	65.1	97.4	625	8.09 J
Manganese	408	255	1960	59.25
Mercury	1.33	3.31	24.45	0.0807 J
Nickel	74.6	145	965	8.99
Selenium	24.6 U	4.8	27.8 U	1.09 J
Silver	4.43 U	1.68	5.55 U	0.0622 J
Thallium	5.07 U	0.34	5.56 U	2.806 J
Tin	9.21	11.0	52.6	1.02 J
Vanadium	3.53 U	1.8	5.56 U	0.98 J
Zinc	240	605	4950	2.62 J

Notes:

This data is based on the 80 TCs from the Mustard Characterization Study with liquid mustard mercury concentrations < 1 mg/kg.

U indicates that none of the values exceeded the PQL.

J indicates the value was estimated because it was between the MDL and PQL.

1.5 TRIAL BURN OBJECTIVES

The objectives for the TOCDF MPF trial burn are to:

- Demonstrate a maximum charge weight and a minimum charge interval while processing TCs with a mustard agent heel and maintaining a 99.9999 percent Destruction and Removal Efficiency (% DRE) of the designated Principal Organic Hazardous Constituent (POHC), which is *bis*(2-chloroethyl)sulfide. (The DRE will be > 99.99 % DRE if the heel is 90 lb or less)

- Demonstrate control of fugitive emissions by maintaining a negative system pressure.

- Demonstrate control of CO emissions to less than (<) 100 parts per million dry volume (ppmdv), corrected to 7 percent oxygen (@ 7 % O_2), on an Hourly Rolling Average (HRA) basis and the total CO emissions are < 1.45 pounds/ hour (lb/hr) to meet the Title V permit limit.

- Demonstrate that PM emissions are:
  - < 29.7 mg/dscm @ 7 % O_2 (MACT Limit);
  - < 0.7 lb/hr (Title V Permit Limit).

- Demonstrate that the combined halogen emissions of hydrogen fluoride (HF), hydrogen chloride (HCl) and chlorine (Cl_2) are < 32 ppm expressed as HCl equivalents, dry basis @ 7 % O_2.

- Demonstrate that the polychlorinated dibenzo-*p*-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) emissions are < 0.40 nanograms/dscm (ng/dscm) 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Toxic Equivalent Concentration (TEQ) @ 7 % O_2.

- Determine the metals emissions to update the DCD Human Health Risk Assessment (HHRA).

- Demonstrate mercury emissions are < 130 µg/dscm.

- Demonstrate the semi-volatile metals (cadmium and lead) emissions are < 230 µg/dscm.

- Demonstrate the low volatility metals (arsenic, beryllium, and chromium) emissions are < 92 µg/dscm.

- Provide data regarding the emissions of Products of Incomplete Combustion (PICs) for updating the DCD HHRA.

- Demonstrate that the emission rate of SO_2 is below the Title V permit limit of 1.0 lb/hr.

- Determine the emission rate of nitrogen oxides (NO_x).

- Establish limitations on waste feed characteristics and process operating conditions in order to ensure compliance with performance standards and risk-based emission limits.

- Demonstrate that the Total Hydrocarbon (THC) emissions are < 10 ppmdv @ 7 % O_2, on an HRA (monitored continuously with a CEMS), reported as propane equivalents.

1.6 TRIAL BURN APPROACH

The MPF TC HD ATB will take the universal approach outlined in the EPA Guidance (5). The universal approach establishes one set of permit conditions or limits applicable to all feed materials. This approach will allow the TOCDF to treat metal containers introduced into the MPF while confining the incinerator's operation to a well-defined set of operating limits or an operating envelope.

Maximum waste feed rates for each container type will be specified in the permit. This gives the incinerator operator the flexibility to process different metal containers, while controlling the overall combustion process within specific limits (including temperature and thermal duty). In addition, it allows the operator to maximize the feed rates of each container type without exposing the furnace to frequent changes in operating conditions.

1.7 PROPOSED MUSTARD TRIAL BURN PROGRAM

This ATB will demonstrate that system operations comply with State and Federal environmental regulations by ensuring the collection of the samples and operating data needed for the RCRA Permit, the data necessary to update the DCD HHRA, and the data to support Title V permit and MACT requirements. The main goal of the MPF TC HD ATB is to demonstrate operation of the MPF while processing TCs, which may contain solids covered by liquid mustard. Maximum charge weights and minimum charge intervals will be established by this ATB. This demonstration will consist of two parts: the demonstration of the mustard DRE and the demonstration of processing TCs with high solid heels.

The MPF TC HD ATB will be conducted as two test conditions, and each test will have three performance runs to meet the trial burn objectives. One condition will use liquid mustard heels in TCs to demonstrate a maximum agent feed rate at minimum temperatures in the MPF PCC and AFB. The second condition will use TCs with solid heels mixed with liquid mustard to demonstrate the processing of the solid residues in the TCs. A mustard agent DRE will not be calculated for Condition 2 because the distribution of waste weight between solids and liquids can not be accomplished quantitatively. Condition 1 will use metals spiking to demonstrate the range of possible metals to be fed to the MPF over the course of the Mustard Agent Campaign.

1.8 TRIAL BURN SAMPLING AND ANALYTICAL PROTOCOLS

The structure of this ATB is based on the objectives stated in Section 1.5. The exhaust gas sampling and analytical methods to be used to quantify specific ATB parameters are taken from SW-846 (1), 40 CFR 60, Appendix A (2), and TOCDF Procedures. Detailed discussions of the sampling and analysis procedures are provided in the QAPP in Appendix A.

The methods used in this ATB include:

- TE-LOP-522 (for sampling) and TE-LOP-562 (for analysis). The Depot Area Air Monitoring System (DAAMS) will monitor the exhaust gas in the MPF Duct between the ID fan and the common stack to determine that the mustard agent DRE is ≥ 99.9999 % (99.99 % if the heel is < 90 lb).

- TE-LOP-524. The Automatic Continuous Air Monitoring System (ACAMS) monitoring the MPF Duct will provide a stop feed if mustard agent is present in the duct.

- A CO and O_2 CEMS will monitor on a continuous basis as directed by Attachment 20 to the RCRA Permit. The CO concentration will be used to demonstrate control of PICs.

- EPA Methods 1 and 2 (2), which will determine traverse sampling locations and flow rates.

- EPA Method 3A (2). Carbon dioxide (CO_2) concentration will be determined using a CEMS to be supplied by the sampling subcontractor.

- EPA Method 4 (2). Moisture content will be determined with each isokinetic sampling train.

- A combined EPA Method 5 (2) and SW-846, Method 0050 (1), which will determine the PM, HF, HCl, and Cl_2 emissions.

- EPA Method 6C (2), which will determine the SO_2 emissions with a CEMS to be supplied by the sampling subcontractor.

- EPA Method 7E (2), which will determine the NO_x emissions with a CEMS to be supplied by the sampling subcontractor.

- EPA Method 29 (1), which will determine the HHRA metals emissions.

- SW-846, Method 0031 (1), which will determine volatile organic compound (VOC) emissions.

- SW-846, Method 0010 (1), which will determine Semi-Volatile Organic Compound (SVOC) concentrations.

- SW-846, Method 0023A (1), which will determine PCDD/PCDF concentrations.

- EPA Guidance (6), which will determine Volatile Total Organic Compound (VTOC) emissions.

- EPA Guidance (6), which will determine Semi-Volatile Total Organic Compound (SVTOC) and Non-Volatile Total Organic Compound (NVTOC) emissions.

- 40 CFR 60, Appendix A, Method 25A, which will govern the performance of a CEMS (provided by the sampling subcontractor) in determining the THCs.

The PICs will be characterized and quantified by correlating data generated from the VOCs, SVOCs, and PCDDs/PCDFs. The target analyte lists for these three analyses include over 200 organic compounds as shown in the target analyte lists in Appendix A. Additionally, unknown compounds will be tentatively identified as described in Appendix A. The Total Organic Compound (TOC) data will be used to update the DCD HHRA.

1.9 FINAL PERMIT LIMITS

Process parameters will be established for the MPF by the MPF TC HD ATB and to meet the MACT requirement of establishing Operating Parameter Limits (OPLs). These process parameters are divided into Group A, B, and C parameters as directed in the applicable EPA Guidance documents (4). Group A and B parameters will be established on the basis of trial burn results. Group C parameters will be established on the basis of regulatory guidance, process design and safety considerations, or equipment manufacturers' recommendations. Anticipated permit operating conditions resulting from the trial burn testing are summarized in Appendix D.

Group A parameters will be continuously-monitored process parameters, which will be tied to AWFCOs. Group B parameters do not require continuous monitoring and will not be interlocked with the AWFCO system; however, detailed operating records will be maintained to demonstrate compliance with permitted operating conditions.

Group C parameters have been established independent of trial burn results, and some of these parameters will be continuously monitored and interlocked with the AWFCO system. For the most part, their respective limits will be based on engineering considerations and good operating practices.

The following Group C parameters are monitored and recorded continuously and interlocked with the AWFCO system:

- CEMS Operation;
- Maximum PCC Pressure;
- Maximum Quench Tower Exhaust Gas Temperature;
- Maximum Quench Brine Density;
- Minimum Capacity of the Brine Surge Tanks; and
- Maximum Agent Stack Concentration.

During shakedown, the AWFCO settings for Group A and interlocked Group C parameters will be those listed in Appendix D. During the trial burn, the interlocks for these parameters will remain operational within the limits listed in Appendix D.

TOCDF expects to establish final permitted limits for mustard agent operations based on engineering considerations and good operating practices as validated during the trial burn. A detailed discussion of the protocol for establishing final permit limits based on the results of the trial burn is provided in Section 9.

1.10 JUSTIFICATION FOR EXEMPTION

The regulatory requirements of 40 CFR 270.19(a) do not apply to the TOCDF because the TOCDF is not seeking an exemption from any of the incinerator or trial burn requirements.

2.0 DETAILED ENGINEERING DESCRIPTIONS OF THE MPF

This ATB plan discusses the requirements of 40 CFR 270.19(b) to conduct a trial burn. This section discusses the current engineering configuration of the TOCDF MPF as required by 40 CFR 63, Subpart EEE and 40 CFR 270.62(b)(2)(ii). Operating parameters will be established for inclusion in the final permit based on the data collected for the ATB. Engineering changes may be encountered during shakedown that will necessitate revisions to this ATB plan, and any such changes will be coordinated with the DAQ and DSHW.

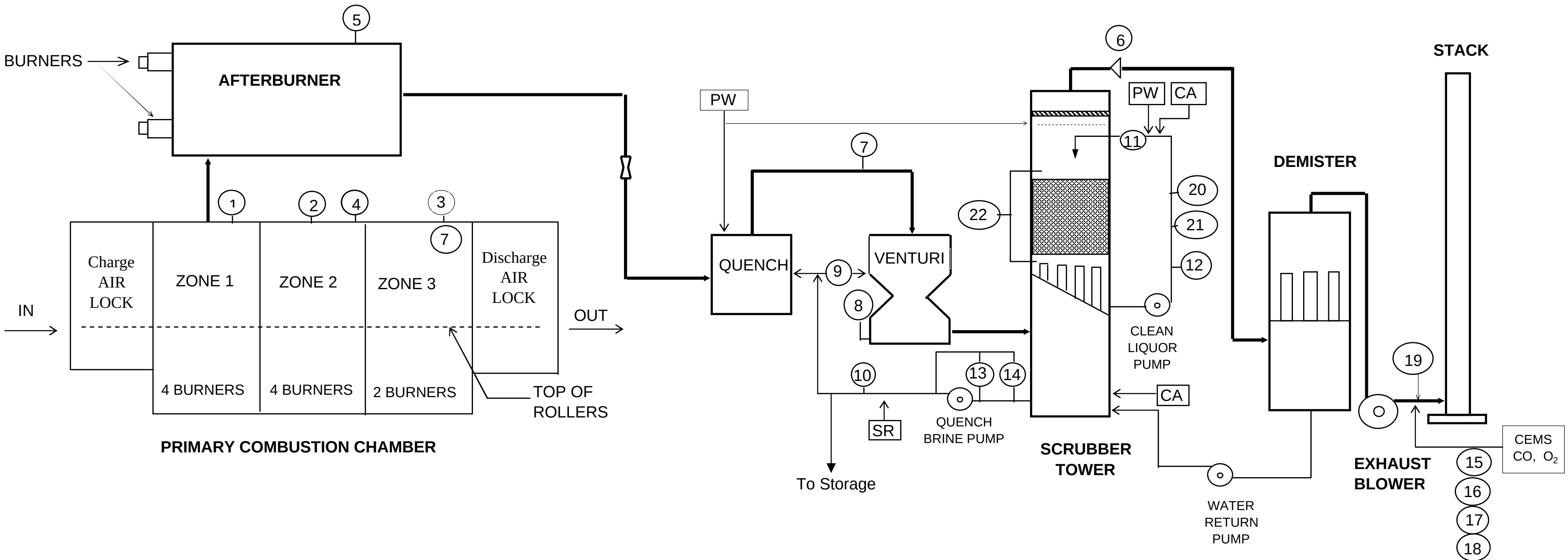
The MPF engineering drawings and specifications were prepared by Ralph M. Parsons, Inc., (Parsons) and EG&G. A selected set of Piping and Instrument Diagrams (P&IDs) and equipment arrangements are provided in Appendix H. A simplified process flow diagram is shown in Figure 2-1, and the design basis for major components of the MPF is summarized in Table 2-1.

The TOCDF MPF is located in the MDB. The MPF was custom fabricated by Wellman Furnaces, Inc., and identified as Model S.O. 89-305; it has been processing metal items contaminated with Agents GB and VX since January 1997. Parsons prepared the certified-for-construction engineering designs and specifications. Wellman Furnaces, Inc., also fabricated the PCC and AFB. Morrison Knudsen constructed the PAS, including the installation of equipment provided by United Engineers and Constructors and Bechtel National.

2.1 PRIMARY COMBUSTION CHAMBER

The PCC is a horizontal, three-zones-in-series, roller-hearth furnace rated at 15.7 million Btu/hr (see Drawing TE-1-D-528 in Appendix H). A charge airlock precedes the PCC and is sealed by a vertical door on each side of the airlock. A discharge airlock follows the PCC and is also sealed by vertical doors on each side of the airlock. The MPF PCC is approximately 41 ft long by 4 ft wide by 6.6 ft high (internal dimensions). This is long enough to hold three munition trays at one time. The PCC is divided into Zone 1 (closest to the charge airlock), Zone 2, and Zone 3, closest to the discharge airlock. The cross-sectional area of the PCC is 26.4 ft^2 with a total volume of 1,089 ft^3. The PCC, including the interior surfaces of the doors, is lined with insulating firebrick, and the shell is carbon steel.

Temperatures in Zones 1, 2, and 3 are approximately the same (1,150°F to 1,800°F). Typically, Zone 1 preheats the tray. Agent is volatilized and combusted in Zones 1 and 2. The tray is further heated in Zone 3 (the burnout chamber) to ensure treatment at 1,000°F for a minimum of 15 min to drive off any remaining agent. The TCs remain in the PCC for a pre-determined period of time (as shown in the MEB in Attachment C), which provides adequate time to destroy any residual organic compounds.



NOTES:

CA = Caustic Makeup (18% NaOH)
PW = Process Water
SR = Wet Scrubber Recirculation Brine Sampling Location

IDENTIFICATION OF RCRA/MACT

1. Primary Chamber Temp. - Zone 1
2. Primary Chamber Temp.- Zone 2
3. Primary Chamber Temp. - Zone 3
4. Primary Chamber Pressure
5. Afterburner Temperature
6. V-Cone Exhaust Gas Flow Rate
7. Quench Tower Exhaust Gas Temperature
8. Venturi Scrubber Diff. Pressure
9. Quench Brine to Venturi Scrubber
10. Quench Brine Delivery Pressure
11. Clean Liquor to Scrubber Tower Sprays
12. Clean Liquor Delivery Pressure
13. Quench Brine Density
14. Quench Brine pH
15. Exhaust Gas CO (Cor. to 7% O_2) - Redundant 1 of 2
16. Exhaust Gas CO (Cor. to 7% O_2) - Redundant 2 of 2
17. Exhaust Gas O_2 - Redundant 1 of 2
18. Exhaust Gas O_2 - Redundant 2 of 2
19. Exhaust Gas Sampling Ports
20. Clean Liquor pH
21. Clean Liquor Density
22. Packed Bed Scrubber Differential Pressure

FIGURE 2-1. MPF PROCESS FLOW DIAGRAM

TABLE 2-1. DESIGN BASIS – MPF MAJOR SYSTEMS

SYSTEM	PURPOSE	DESIGN BASIS
Primary Combustion Chamber	Volatilization and combustion of residual agent waste; decontamination of bulk containers, munitions, and miscellaneous waste	Height: 41 ft (inside dimension) Width: 4 ft (inside dimension) Height: 6.6 ft (inside dimension) Maximum thermal input: 15.7 million Btu/hr Maximum feed rate: Varies with munition type
Afterburner	Destruction of organic compounds	Length: 38 ft (inside dimension) Diameter: 4 ft (inside dimension) Maximum thermal input: 8.5 million Btu/hr Exhaust gas residence time: > 0.5 seconds Nominal exhaust gas flow: 21,946 acfm Minimum gas exit temperature: 1,800 °F
Combustion Air Blower	Combustion air for PCC and AFB, sparge air for PCC Zone 3, and AFB dilution air	Design capacity: 7,640 scfm Design static head: 56.5 inWC Motor size: 100 hp
Quench Tower	Rapid reduction of exhaust gas temperature and saturation of exhaust gases	Height: 40.0 ft Diameter: 6.0 ft Adiabatic cooling capacity: ≈ 28,500,000 Btu/hr Design pressure: Full vacuum to 15 psig Design temperature: 1,250 °F
Venturi Scrubber	Removal of particulates and acid gases	Design pressure: Full vacuum to 15 psig Design temperature: 250 °F Design differential pressure: 20 to 50 inWC
Scrubber Tower	Neutralization of acid gases; surge volume for Brine and clean liquor	Height: 40.0 ft Diameter: 5.5 ft Design pressure: Full vacuum to 15 psig Design temperature: 250 °F
Demister	Removal of entrained solids and liquid droplets	Height: 31.0 ft Diameter: 11.0 ft Design pressure: -5 psig to 15 psig Design temperature: 200 °F
Induced Draft Fan	Prime mover of exhaust gases	Stages: 2 Design capacity: 22,500 acfm Design static head: 76.5 inWC at 176 °F Motor size: 250 hp, each stage
Emergency ID Fan	Maintenance of negative MPF pressure if ID fans are lost	Stages: 1 Design capacity: 4,320 acfm Design static head: 11.4 inWC at 176 °F Motor size: 25 hp
Process Exhaust Stack	Atmospheric dispersion of process exhaust gases	Design gas flow rate: 75,600 acfm Design gas temperature: 220 °F Height (to tip): 100 ft Diameter (at tip): 5 ft Diameter (at base): 9 ft 6 inches

The PCC is equipped with five water spray nozzles to assist in temperature control in Zones 1 and 2. Zone 1 contains 3 spray nozzles and Zone 2 contains 2 spray nozzles, all located above the conveyor. When the zone temperature reaches a setpoint (typically 50 °F above the setpoint of the zone temperature controller), a control valve opens to spray water into the zone. A small amount of plant air is continuously sprayed through the nozzles for cooling and to atomize the water.

The PCC is heated throughout its length by fuel gas burners. Excess air is maintained in the furnace to ensure combustion of residual agent, and exhaust gases from the PCC exit to the AFB. Decontaminated munitions and other solid residues are left on the trays and moved from the PCC to the discharge airlock.

The MPF is designed with a double-door airlock system. This system prevents the PCC from being open to the MDB or the cool down area while in operation, and maintains positive containment of the exhaust gases in the PCC. The airlock system also prevents materials containing agent from being discharged from the MPF when the airlock doors are open. In addition, the use of the double doors helps maintain constant PCC temperature.

These airlocks each have a capacity for one tray. The charge airlock outer door is opened to allow a tray to be fed to the system. The tray is fully inserted into the charge airlock and the outer charge door closes. After the outer charge door is closed, the transition door from the charge airlock to the PCC is opened, and the tray is moved to Zone 1. Feed trays are indexed through the three PCC zones based on the zone timers for the specific munitions being processed.

The discharge airlock isolates the PCC from the outside environment. Trays in the discharge airlock are cooled and monitored for agent to ensure that the processed materials contain no agent. The outer door of the discharge airlock is closed before the inner PCC door can be opened. The inner door is opened and a tray is moved from Zone 3 into the airlock. The inner door is closed and air lines with automatically-operated valves introduce cooling air from the MPF room to cool the munitions and tray. The cooling air moves from the airlock to the AFB. Valves control the introduction and discharge of air. Both valves must be closed for either airlock door to open, and they open together to avoid pressurizing the discharge airlock. A timer allows the munitions to be cooled and monitored. Next, the valves close and the outer door is opened. Then, the tray is discharged to the cooling conveyor.

Movements of trays through the different zones are controlled. One Zone remains empty until the agent monitoring in the discharge airlock verifies that there is no residual agent in the tray. If incomplete destruction of agent is detected, the tray is returned to the PCC for continued heating.

Cooling is necessary to control the heat radiated from the trays in Zone 3. The discharge airlock inner door contains built-in cooling water piping to assist the free motion of the door and to ensure a tight closure. Cooling water piping is connected to a secondary cooling water system external to the furnace.

A single combustion air blower provides air to the PCC and AFB burners. A back-up combustion air blower will automatically take over if something happens to the primary blower. During TC processing, sparge air is introduced in Zone 3 to ensure complete combustion of any residual agent. This sparge air is directed into one of the holes punched in the top of the TCs. The holes are punched to allow access to drain agent and to allow air to circulate through the TCs to promote burnout of combustible materials.

2.2 AFTERBURNER

Exhaust gases are discharged from the PCC through the refractory-lined crossover duct into the AFB. The AFB (see Drawing TE-1-F-503 in Appendix H) was also designed by Wellman Furnaces, Inc. It is a horizontal, steel, cylindrical shell, 38 ft long and 4 ft in diameter (inside dimensions), lined with 4 inches of K-30 insulating firebrick; it is mounted directly over the PCC. The cross-sectional area of the AFB is 12.6 ft^2, and its total volume is 477 ft^3. Two fuel gas burners are used in the AFB, which results in a rating of 8.5 million Btu/hr. The AFB maintains gas temperature between 1,800 °F and 2,175 °F for a minimum of 0.5-second residence time to ensure complete combustion of organic compounds. Excess air is supplied to the AFB to ensure complete combustion of residual organic compounds, including agent.

The final use of MPF combustion air is to ensure that the AFB oxygen concentration remains above 8 %. At 8 %, output from a high-speed oxygen analyzer in the AFB exhaust energizes control valves to add air into each side of the AFB through two ducts. The airflow continues in 5-min increments until an 8 % oxygen concentration is achieved. If the AFB temperature reaches 2,050 °F, dilution air is also activated to assist in combustion and aid in AFB cooling.

2.3 BURNERS

The PCC and AFB burners are conventional burners rated at 1.57 and 4.25 million Btu/hr, respectively. A 10-second gas pilot ignites the burners, which operate at excess air. Each burner has a fuel gas pilot and a flame guard system. The burner bodies are fabricated of heat-resistant cast iron, with internal components of a high-grade alloy, and the burner block is refractory tile. Depictions of the burner locations in the chambers are included in Appendix H, drawings TE-1-F-503 and TE-1-D-530.

The PCC burner system consists of 10 burners that maintain decontamination temperatures and provide high-temperature oxidation of the agent. Four burners are located in Zone 1, four in Zone 2, and two in Zone 3. Each zone has individual temperature controls. The burners in each of the three zones are split, two above and two below the munitions tray level for Zones 1 and 2, and one above and below for Zone 3. This arrangement creates a circulating gas flow in each furnace zone.

The PCC operates at a gas temperature range of 1,150 °F to 1,800 °F. The controllers for each of the PCC burners set the airflow of the supplied combustion air at a constant rate. This yields a variety of air-to-fuel ratios, all of which are greater than 1.2, which is 20 % excess air (the stoichiometric ratio is 10:1).

The AFB burners are located about midway up the vessel end above the discharge from the crossover duct. The controller for each of the AFB burners modulates the combustion airflow to maintain a constant air-to-fuel ratio.

All burners are equipped with independent monitors, controls, interlocks, and fail-safe devices required by the National Fire Protection Association. This equipment includes Fire-Eye flame scanners as part of the flame safety management system. These scanners continuously monitor flame conditions and are interlocked to stop waste feed automatically in the event of a flameout.

2.4 AUXILIARY FUEL SYSTEMS

Natural gas is fired to heat both the PCC and the AFB to the proper operating temperatures prior to feeding and to maintain proper temperatures during processing. Each zone is individually temperature controlled in the PCC, and combustion air is supplied to all burners at a constant rate. Fuel flow rates are determined by temperature controllers modulating flow control valves to maintain desired zone and AFB temperatures.

2.5 PRIME MOVER

Three blowers are used in the MPF. The exhaust gas prime mover is a Robinson, Model RB5800, two-stage (two fans operated in series) centrifugal fan that operates as an ID fan to draw the exhaust gases through the incinerator and PAS. Under normal conditions, the ID fan operates at 22,500 actual cubic feet per minute (acfm), drawing 176 °F exhaust gas (saturated with water) at a static differential pressure of approximately 76.5 inWC. A 250-hp, totally-enclosed, fan-cooled motor powers each stage of the fan. To mitigate main exhaust blower failure when the furnace is loaded, the MPF includes a parallel, automatically-started, emergency ID fan. The emergency ID fan is a Robinson, Model RB1216, single-stage centrifugal fan, rated at 4,320 acfm with a differential pressure of 12.3 inWC. The emergency ID fan provides enough flow to maintain negative furnace pressure and allow relighting the AFB if a combustion air blower is operating. One 25-hp, totally-enclosed, fan-cooled motor powers the fan. Both MPF combustion air blowers are Robinson, Model RB1216, single-stage fan, which can provide up to 7,640 acfm of 125-°F air at a differential pressure of 56.5 inWC. A 100-hp, totally-enclosed, fan-cooled motor powers each fan.

2.6 WASTE FEED SYSTEM

Two types of waste materials are fed to the TOCDF MPF:

- Bulk containers with < 632 lb of agent and munitions.

- Miscellaneous waste, including non-munition, agent-contaminated debris; agent systems residues; process equipment; High Efficiency Particulate Air (HEPA) filters; carbon filter trays; munitions over pack containers; and discarded tools.

Bulk containers and munitions casings move on trays via electrically-powered conveyors from the Munitions Processing Bay to the Lower Buffer Storage Area. There, a charge car routes them into the Lower Munitions Corridor and back into the Lower Buffer Storage Area, TMA, or directly to the MPF.

Loaded trays intended for MPF processing are positioned by the charge car conveyor. Processing begins when a tray is transferred into the MPF charge airlock from the first floor munitions corridor charge car. When the charge car is aligned with the feed conveyor, and the charge airlock and Zone 1 are empty, the airlock inlet door is opened. The charge car and airlock conveyors transfer the tray to the airlock. When the tray is in the proper position, both conveyors stop, and the airlock inlet door lowers and clamps.

A tray enters the furnace when the charge airlock inner door unclamps and opens. Then, the tray is transported into Zone 1 by running the feed conveyor and Zone 1 conveyor until it is properly positioned on the Zone 1 conveyor. Both conveyors then stop, and the charge airlock inner door lowers and clamps. The MPF system has the ability to process trays semi-continuously; as one tray passes through a section, another tray follows, allowing cyclic loading of the furnace.

Miscellaneous wastes are handled and fed similarly. The wastes are loaded onto waste trays and moved by conveyor to the Lower Munitions Corridor. There the charge car conveys it into the MPF, similar to the way munitions are moved.

2.7 RESIDUE HANDLING SYSTEM

Loose residues will occasionally be found on containers or casings exiting the MPF. Containers and casings are held in an enclosed area until cool to prevent uncontrolled atmospheric release of any loose residues. Loose residues will be removed from the TCs and munitions while they remain in the enclosed area. Disposal of any resulting decontaminated residue will be in accordance with the WAP.

2.8 AUTOMATIC WASTE FEED CUTOFF SYSTEMS

The primary function of the AWFCO system interlocks is to prevent feeding hazardous waste when incineration conditions are outside the RCRA or Title V permit limits. During process upsets, the interlock system will prevent feed until the incinerator is at the proper operating conditions and the interlock is manually reset. The AWFCO system are tested every 14 days, and the DSHW will be notified 7 days in advance of the first AWFCO test before mustard agent is burned in the system. Feed must be reinitiated manually after any AWFCO has been cleared and reset. Listings of the process monitoring instruments that make up the AWFCO system and their setpoints are in Appendix D.

The final AWFCO parameter values for permitted operation under 40 CFR 264, Subpart O, are expected to be negotiated between DSHW and the TOCDF, based on the results of the trial burn. A general description of AWFCO parameters follows:

- PCC Zone Temperatures - The gas temperature in each PCC zone is monitored continuously by 14-TIT-152, 14-TIT-141, and 14-TIT-153. Feed to the incinerator stops if the gas temperature falls below the low temperature setpoint on a HRA basis or rises above the high temperature setpoint on an instantaneous basis.

- AFB Exhaust Gas Temperatures - The temperature of the AFB exhaust gases are monitored continuously by 14-TIT-065. Feed to the MPF stops if the AFB gas temperature falls below the low temperature setpoint on an HRA basis or rises above the high temperature setpoint on an instantaneous basis.

- Furnace Pressure - A negative pressure is maintained in the MPF to control fugitive emissions. The differential pressure between the PCC and the furnace room is monitored continuously by pressure indicating transmitter 14-PIT-070. Pressure switch 14-PSHH-034 activates an MPF AWFCO if the differential pressure exceeds the permitted value for one minute.

- Exhaust Gas Flow Rate - The pressure drop across a V-Cone® in the exhaust duct is measured and converted to an exhaust gas flow rate. The velocity pressure differential from the V-Cone® is continuously monitored by a pressure differential indicating transmitter, and a Programmable Logic Controller (PLC) uses these data to calculate the exhaust gas flow and then sends the data to PDARS as 24-FIT-9667. Waste feeds are stopped when the exhaust gas flow exceeds the setpoint established during the ATB on an HRA basis.

- Quench Tower Exhaust Gas Temperature – The quench tower exhaust gas temperature is continuously monitored by thermocouple and temperature indicating transmitter 24-TIT-509. High quench tower exhaust gas temperatures could result in failure of downstream process equipment and a safety hazard to personnel. High temperatures are indicative of the loss of Brine flow or a plugged spray nozzle, which results in inadequate cooling of the exhaust gases. Temperature switch 24-TSHH-223 activates an AWFCO if the quench tower exhaust gas exceeds the high temperature setpoint on a HRA.

- Brine Delivery Pressure - Brine pressure is continuously monitored by 24-PIT-233 at the discharge of the Brine pump. Low pressure causes insufficient cooling of the exhaust gas. Waste feed to the MPF stops automatically if this pressure falls below the setpoint on an instantaneous basis.

- Brine Flow to the Venturi Scrubber - The Brine flow to the venturi scrubber is continuously monitored by a flow sensor and flow indicating transmitter 24-FIT-218. Adequate Brine flow to the venturi scrubber is essential for proper scrubbing of the exhaust gases. Waste feed to the MPF is stopped if the measured value falls below the setpoint on a HRA basis.

- Venturi Scrubber Differential Pressure - The differential pressure across the venturi scrubber is continuously monitored by pressure differential indicating transmitter 24-PDIT-222. Waste feed to the MPF is stopped if the measured value falls below the setpoint on a HRA basis.

- Brine pH - The pH of the Brine solution is monitored continuously by pH probes and analyzer indicating transmitters 24-AIT-224A and B to ensure that the Brine remains alkaline. One probe at a time is active and provides the input to the PLC. Waste feeds are stopped if the measured value falls below the setpoint on a HRA basis.

- Clean Liquor pH – The pH of the clean liquor is monitored continuously by pH probes and analyzer indicating transmitters 24-AIT-247A and B to ensure the clean liquor remains alkaline. One probe at a time is active and provides the input to the PLC. Waste feeds are stopped if the measured value falls below the setpoint on a HRA basis.

- Brine Density - High Brine density could lead to reduced flows, clogging of nozzles, and formation of solid deposits in system piping. Brine density is measured continuously by a density probe and density indicating transmitter 24-DIT-216. If the Brine density exceeds the 12-hr rolling average setpoint, waste feed to the MPF stops automatically.

- Clean Liquor Density – High clean liquor density could lead to reduced flows, clogging of nozzles, and formation of solid deposits in system piping. Clean liquor density is measured continuously by a density probe and density indicating transmitter 24-DIT-249 and provides the input to process controller 24-DIC-249. If the clean liquor density exceeds the 12-hr rolling average setpoint, waste feeds to the MPF are stopped.

- Clean Liquor Flow Rate - Clean liquor is added to the top of the packed bed scrubber by pumping fluid through distribution trays over the top of the pall rings. The clean liquor flow rate to the packed bed scrubber sprays is continuously monitored by flow sensor and flow indicating transmitter 24-FIT-248. Waste feed is stopped if the flow rate to the packed bed scrubber tower sprays falls below the setpoint on a HRA basis.

- Clean Liquor Delivery Pressure - Clean liquor pressure is measured continuously by 24-PIT-258 at the clean liquor pump discharge. Insufficient clean liquor pressure indicates pump or piping failure. Either failure prevents delivery of clean liquor to the packed bed scrubber, thus affecting the effectiveness of the scrubber tower in removing pollutants. Waste feed to the MPF stops automatically if clean liquor pressure falls below the setpoint.

- Blower Exhaust CO Concentration – The CO concentration is measured continuously at the ID fan discharge by CO monitors 14-AIT-384 and 24-AIT-669. The CO AWFCO stops waste feed to the MPF automatically if the HRA CO concentration, as measured by either device, exceeds the permitted value corrected to 7 % O_2, dry basis. The O_2 correction factor is calculated using the following equation:

$$CO_c = CO_m \times \frac{14}{(21 - O_{2m})}$$

where:

CO_c = the exhaust gas CO concentration corrected to 7 % O_2, dry basis
CO_m = the measured exhaust gas CO concentration, dry basis
O_{2m} = the measured exhaust gas O_2 concentration, dry basis

- Blower Exhaust O_2 Concentration – The O_2 concentrations are monitored continuously at the ID fan discharge by O_2 monitors 14-AIT-082 and 24-AIT-670. If O_2 concentrations reach either the low setpoint or the high setpoint, feed to the MPF stops.

- MPF Exhaust Gas Agent Concentration - The exhaust gas ducts of the four TOCDF incinerators discharge their exhaust gases to the atmosphere through a common stack. Concentrations of mustard in the exhaust gas in the duct between the ID fan and the common stack (MPF Duct) are measured using ACAMS during long-term operations. Two mustard ACAMS will be in each duct with one operating and the other in standby mode. The MPF Duct ACAMS are designated PAS 703. Three ACAMS will be used to provide continuous monitoring in the MPF Duct during this ATB. The ACAMS sampling cycles (sample collection followed by sample desorption and analysis) are adjusted so that one ACAMS is collecting an exhaust gas sample as the second is analyzing an exhaust gas sample. One ACAMS is used for backup and is brought on-line during challenges or malfunction of one of the other ACAMS. The ACAMS data is electronically recorded each time a change in exhaust gas agent concentration is measured. Waste feed to the MPF will be stopped if either of the on-line ACAMS measures a concentration of agent in the exhaust gas that equals or exceeds the setpoint.

- Common Stack Agent Concentration - The agent concentrations in the combined exhaust gases of all four TOCDF incinerators are continuously monitored in the common stack. The operation of the ACAMS and those ACAMS in use during the LIC Mustard ATB will be controlled by Attachment 22 to the TOCDF RCRA Permit (7). To monitor for Agents GB, VX, and mustard would require nine ACAMS: three ACAMS are used to monitor for Agent GB (PAS 701 series); three ACAMS are used to monitor for Agent VX (PAS 706 series); and three ACAMS monitor for mustard (PAS 707 series). Their sequenced, or staggered, operation is similar to that described previously. Waste feed to all incinerators is stopped if either of the on-line ACAMS measures a concentration of agent in the exhaust gas that equals or exceeds the setpoint in Appendix D.

- Scrubber Tower Bed Differential Pressure – The pressure differential of the scrubber tower is monitored continuously by 24-PDIT-225. Waste feeds are stopped if the measured value falls below the setpoint on a HRA basis.

- Brine Surge Tank Full - Liquid levels in Brine surge tanks 101, 102, 201, and 202 are continuously monitored by level indicating transmitters 23-LIT-002, -006, -702, and –706 to ensure that there is always a repository for PAS Brine blowdown. If all tank levels rise above the permitted maximum, feed to the MPF stops.

The TOCDF control system is designed to minimize AWFCOs and ensure that the system is in compliance. Two CO and O_2 instruments are used with one designated the primary and the other the backup. For these parameters, the AWFCO will be activated when either of the properly functioning CEMS detects conditions beyond the setpoints. In general, when an instrument fails, it will go out of range and create an alarm in the PLC to alert the operator of the problem. In monitoring critical functions, the TOCDF control system gives advanced warnings, using pre-alarms where possible, indicating that an alarm condition is developing and warning operators in time to take preventive action.

The measurement devices that initiate AWFCOs are calibrated and maintained on a regular basis as directed by TOCDF procedures. Most instruments are calibrated on a 180-day schedule. The pH devices 24-AIT-224A and B require standardization and transmitter adjustment on a weekly basis. The CEMS are checked on a daily basis and undergo an annual Performance Specification Test (PST), and the ACAMS are challenged every 4 hr. An AWFCO will occur if any of these measuring devices fails or malfunctions.

2.9 EXHAUST GAS MONITORING EQUIPMENT

Exhaust gases from the MPF are monitored on a continuous basis. The CEMS monitor CO and O_2. Separate agent monitoring systems located in the MPF Duct monitor the chemical agent being processed. Outputs from these monitors are sent to PLCs, which display the results in the Control Room, calculate HRA, and archive the data in the Process Data Acquisition and Recording System (PDARS) for future reference.

2.9.1 Continuous Emission Monitoring Systems

The CEMS monitor exhaust gas concentrations of CO and O_2. The CEMS will meet all of the performance specifications detailed in “Standards of Performance for New Stationary Sources” (8). Permanently installed CEMS probes are located in the MPF Duct between the ID fan and the common stack. The probes supply exhaust gas to the analyzers dedicated to monitoring the MPF exhaust gas.

The primary functions of the CEMS are to continuously measure, display, and record the gas concentrations in the MPF Duct. Output from the CEMS will activate alarms and interrupt waste feed when preset values are exceeded. The CEMS will remotely display gas composition and CEMS operational status. The MPF CEMS instrumentation is located in a climate-controlled monitoring room located next to the MPF Duct in the PAS area. The CEMS data are recorded in PDARS.

The PLC will transmit data to the PDARS, which will provide remote data recording of CEMS operations in the plant Control Room. All analog and digital input/output signals will be conditioned properly to reduce noise and isolate signals from voltage transients. The PDARS will record the corrected and HRA gas concentrations. Gas composition will be indicated and updated at least every 15 seconds. In addition, the PLC will activate alarms and initiate an AWFCO when high CO, low O_2, or high O_2 concentrations are in the exhaust gas or when the PLC experiences a loss of analyzer signal.

The exhaust gas sample enters the CEMS train through a probe assembly located in the exhaust gas duct. The sample is then drawn through a heated line to the sample conditioning system, where it is prepared for analysis in the analyzers.

2.9.1.1 CO Monitors

The CO analyzers 14-AIT-384 and 24-AIT-669 are Teledyne, Advanced Pollution Instrumentation (API) Division model 300EM, non-dispersive infrared (NDIR) analyzers as described in 40 CFR 60, Appendix A, Method 10 (2). The analyzers are calibrated on two ranges, according to Attachment 20 (3), within the expected concentration ranges for the incinerator. These calibrations include analyses of a zero gas and a span calibration gas. The CO monitor sends a reading to a PLC every 15 seconds. The readings are averaged over 1-min and corrected to 7% O_2 based on input from the O_2 CEMS by the PLC. The PLC calculates an

HRA from the 1-min averages, and the averages are sent to the PDARS. The 40 CFR 60, Appendix B, Performance Specification 4B, is used to evaluate the CO CEMS performance and determine whether the CO CEMS meets the calibration drift requirements. The CO CEMS initiates an AWFCO when either independent analyzer detects CO concentrations higher than the setpoint. If one CO monitor fails or is taken offline, data from the other CO monitor will be used to verify correct system operation. If both CO monitors fail, an AWFCO will be initiated.

The NDIR analyzer's specifications include:

- Ranges: 0-200, 0-5000 ppm;
- Accuracy: ± 1 % of full scale;
- Drift: < 1 % of full scale per week;
- Reproducibility: < 0.5 % of reading; and
- Response time: Variable, 90 % of full scale in 0.5 to 20 seconds, application dependant.

The CO CEMS are drift checked daily. Gases of 0 to 2 % and 60 to 90 % of instrument span are used to drift check the CO analyzers. Calibration gases are injected into the sampling system at the duct by opening the solenoid valve on each certified gas standard cylinder to allow the reference gas to flow, under pressure, to the sample probe. The reference gas is drawn through the sample transport, sample conditioning, and sample delivery system and is analyzed in the same manner as an exhaust gas sample. Calibration results are stored and printed through the PDARS. The concentrations of the reference gases span the expected concentrations of the exhaust gas. The span gas calibrations are considered a verification of the quality of the CEMS data.

2.9.1.2 O_2 Monitors

The O_2 analyzers 14-AIT-082 and 24-AIT-670 are Ametek Thermox Instrument Division FCA zirconium oxide electrochemical detectors. The analyzers are calibrated according to Attachment 20 (3), using a zero gas and span calibration gases. The 40 CFR 60, Appendix B, Performance Specification 3 (9), is used to evaluate the O_2 CEMS. The Thermox Ametek FCA analyzer specifications include:

- Range: 0-25 Volume %;
- Accuracy: ± 2 % of full scale;
- Drift: < 0.1 % of cell output per week;
- Reproducibility: ± 0.2 % of measured value; and
- Response time: 90 % of step change in 5 seconds

The O_2 CEMS are calibrated daily using a two-point calibration method. Gases of 0 to 2 % and 60 to 90 % of instrument span are used to calibrate the O_2 analyzers. Calibration gases are injected into the sampling system at the duct by opening the solenoid valve on each certified gas standard cylinder to allow the reference gas to flow, under pressure, to the sample probe. The reference gas is drawn through the sample transport, sample conditioning, and sample delivery system and is analyzed in the same manner as an exhaust gas sample. Calibration results are stored and printed through the PDARS. The concentrations of the reference gases span the expected exhaust gas concentrations. The span gas calibrations are considered a verification of the CEMS data quality.

2.9.2 Agent Monitoring Systems

Operations of the Agent Monitoring Systems are discussed in Attachment 22 to the TOCDF RCRA Permit (7). Agent concentrations in the plant and in the exhaust gas are monitored using ACAMS and DAAMS. Agent monitoring during the Mustard Agent Campaign will be controlled by Attachment 22 (7) and it may include multi-agent monitoring. These systems have undergone extensive testing and evaluation under both simulated and actual field conditions. Testing and evaluation of the mustard monitoring systems will be provided to DSHW prior to the beginning of the shakedown period.

Operation of the ACAMS and DAAMS is controlled by Laboratory Operating Procedures (LOPs). These systems use gas chromatography (GC) for the detection of mustard.
Agent is monitored on a continuous basis to ensure that chemical agents are not emitted to the environment. Therefore, an AWFCO will be initiated any time an ACAMS alarm occurs in the MPF Duct (PAS 703) or the common stack (PAS 707 for mustard agent). These ACAMS alarms are the only ones that will impact sampling directly; if PAS 703 or PAS 707 ACAMS alarm or malfunction, sampling will cease.

A malfunction will cause ACAMS to alarm, but a malfunction is different than an alarm: a technician responds to an alarm and determines whether the ACAMS is malfunctioning. If it is a malfunction, the DAAMS tubes will not be analyzed, and feed will resume. If it is an alarm rather than a malfunction, the DAAMS tubes will be analyzed to ensure that agent is not present.

A stop feed during processing does just that – it stops the feed into the MPF. However, the furnace will still be processing the feed that is already in the furnace, so sampling will continue through the stop feed, unless the scheduled feed was missed, which would have caused the sampling to stop. If sampling stops, it will resume when the MPF has been reloaded with TCs. When an ACAMS alarms (and is not due to a malfunction), DAAMS tubes are analyzed for verification. There are several alarm scenarios possible. One alarm scenario involves only an ACAMS alarm in the duct (PAS 703). In this case, sampling ceases, and the DAAMS tubes from the duct and stack are analyzed. If agent is confirmed, the test terminates; if agent is not confirmed, feed resumes. Sampling then continues or resumes when the furnace has been reloaded. The next scenario involves an ACAMS alarm only on the stack. The DAAMS tubes from the common stack and all duct stations are analyzed. If agent is confirmed, the test is terminated; if no agent is confirmed, feed will resume, and sampling will resume when the MPF has been reloaded. The final scenario involves ACAMS alarms at both locations. The DAAMS tubes from the stack and duct are both analyzed. If agent is confirmed in either set of DAAMS tubes, the test terminates; if no agent is confirmed, feed resumes. As in the previous two scenarios, sampling continues or resumes when the MPF has been reloaded.

The precision and accuracy of each monitoring system is determined through actual on-site testing, after installation of the equipment, and then is checked at periodic intervals. These data are used to establish procedures for quality control bounds, calibration and challenge frequency. These challenge frequencies and procedures are delineated in each system's QC plan.

2.9.2.1 Automatic Continuous Air Monitoring System

The ACAMS provides quantitative agent data and is capable of detecting mustard at the Immediately Dangerous to Life and Health (high-level), the Short Term Exposure Limit (STEL) (low-level) set by the U.S. Surgeon General for unmasked workers, or the Source Emission Limit (SEL) level. Operation of the ACAMS is covered in TE-LOP-524

The ACAMS represents state-of-the-art instrumentation for the detection and quantification of furnace exhaust gases and chemical agents in workplace environments. These two environments are substantially different in their composition and potential interferences. Exhaust gases are difficult to sample because of their high temperature and high moisture content. The ACAMS Dilution Air Flow Controller (ADAFC) is used in conjunction with the ACAMS to allow sampling directly from a duct. The ADAFC provides more accurate and reproducible results by conditioning the exhaust gas prior to sampling and analysis.

The ADAFC mixes instrument air with the exhaust gas sample before it enters the ACAMS. The instrument air lowers the dew point of the sampled gas, thereby preventing moisture from condensing in the sample lines or the ACAMS. Mustard operations require the gases entering the ACAMS to be composed of 5 % exhaust gas and 95 % instrument air, and the ADAFC maintains this constant 5 %:95 % ratio to allow the ACAMS software to accurately quantify any agent present. When analyzing agent concentrations in the SEL or STEL modes of operation, the ACAMS use a formula based on a measurement of total sample flow over a given amount of time. When an ADAFC is added to the system, the ACAMS measures a total sample volume (sample flow rate multiplied by the sample time) that is 19 times the actual sample volume from the duct. The concentrations of the calibration standards compensate for this dilution.

The 5:95 ratio of the exhaust gas sample to the instrument air dilution stream must remain constant to ensure the reported concentrations remain accurate. These flows are monitored automatically and prompt a malfunction alarm if any flow drifts out of tolerance. They will be verified with a calibrated flow controller at the beginning and end of each run for the ATB. There are two instruments used to measure the flow of the sample stream (5 %) and the dilution stream (95 %). The 5 % flow is measured with a 0.5 L/min flow instrument with an accuracy of ± 2 % of full scale (± 10 mL/min). The 95 % flow is measured with a 2 L/min flow instrument with an accuracy of ± 2 % of full scale (± 40 mL/min). The DSHW will be notified when the flows will be verified so that they may observe the test. The evaluation and testing program for these units in the field are rigorous. Precision and accuracy data are generated while sampling actual exhaust gases during non-agent operations. The Limit of Quantitation (LOQ) of the ACAMS at the SEL level is 0.006 mg/m^3 mustard. Testing and evaluation in all agent modes have been completed, and all monitors met the 95 % confidence level for ± 25 % accuracy.

The ACAMS provides quantitative agent data for analysis and consists of a sampling pump, a sample collection module, a Gas Chromatograph with a Flame Photometric Detector (GC/FPD), a monitor with strip chart recorder, and a computer interface module for automated data acquisition. The ACAMS uses the GC column to separate other compounds from agent and the selectivity of its FPD to improve the specificity of the response to chemical agents.

The ACAMS cycle time in the mustard mode will be 5 min based on testing results. The ACAMS cycle time is divided into a sample collection period and a purging and analysis period. To provide continuous monitoring of the exhaust gas for mustard during the ATB, there will be two ACAMS online and a backup at both the MPF Duct sample location and the common stack. The instruments will be cycled so that one ACAMS will sample the gas at each location while the other ACAMS is in the purge/analysis mode. If the stack ACAMS cycle times are not in the correct sequence, an alarm and an AWFCO will be activated. ACAMS sequencing in the MPF Duct will be checked hourly during the MPF TC HD ATB. The third ACAMS will be held in reserve to be used if an ACAMS fails. The additional ACAMS also allows the ACAMS to be challenged offline without affecting the ability to continuously monitor the exhaust gas.

During the Mustard Campaign, the normal configuration of ACAMS in this duct will be two ACAMS monitoring for mustard; one will be in operation while one is on standby. An alarm from either ACAMS will result in an AWFCO.

2.9.2.2 Depot Area Air Monitoring System

The DAAMS is a sampling and analysis technique capable of detecting Agents GB, VX, and mustard in ambient air at the STEL limits established for unmasked workers by the U.S. Surgeon General. TE-LOP-522 and TE-LOP-562 cover collection and analysis, respectively, of DAAMS tube samples. A DAAMS sampling station is located at the MPF Duct and the common stack near the ACAMS sampling points. The agents monitored will be controlled by Attachment 22 (7)

A DAAMS Dilution Air Flow Controller (DDAFC) conditions the exhaust gases sampled by the DAAMS. The DDAFC lowers the exhaust gas dew point to improve collection efficiency for organic compounds on the DAAMS tube sorbent bed for subsequent analysis. The DDAFC operates like the ADAFC (i.e., the flow through a DAAMS tube is controlled to maintain a ratio of 5 % moist exhaust gas to 95 % dry instrument air). Exhaust gas flows will be between 4.0 % and 6.0 %. The lowest flow rate from the DDAFC is used to calculate the DAAMS tubes total flow. The Chemical Assessment Laboratory (CAL) will analyze the DAAMS tubes. The LOQ for a DAAMS tube analysis is about 0.006 mg/m^3 mustard or about 68 times less than the SEL.

Normally, the exhaust gas flow and the instrument airflow are verified with calibrated flow controllers once per day. The 5 % exhaust gas flow is measured with a 0.5 L/min instrument accurate to ±2 % of full scale (± 10 mL/min). The 95 % volume is measured with a 10 L/min instrument, which is accurate to ± 2 % of full scale (±200 mL/min). During the trial burn, each DAAMS set will be leak checked after placement in the sampler. The DDAFC exhaust gas and instrument airflows will be verified at the beginning and end of each trial burn run. The worst-case flows will be used to calculate the mass of mustard agent exiting the system, which will be used for the DRE calculations. The DSHW will be notified when the 5 % exhaust gas to 95 % instrument air ratio will be verified so that they may observe the test.

A Quality Plant (QP) sample is a field surrogate sample, and one will be run with each DAAMS set during the ATB to verify that agent is not lost from the DAAMS tubes during sample collection. The QP sample is a DAAMS tube spiked with mustard before the sample collection.

The DAAMS tubes will be used to determine the agent concentrations used in the DRE calculation for the ATB. In the case of an ACAMS alarm, the sample time used to calculate the DAAMS concentration will equal the time the ACAMS is in alarm. If the normal DAAMS sample period ends during the alarm condition, the sampling period will be extended until the ACAMS clears to avoid missing any mustard in the exhaust gas. The DAAMS sampling period for DRE during the trial burn will be about one hour per set unless there is an agent alarm.

2.10 POLLUTION ABATEMENT SYSTEM

The MPF PAS includes the following equipment:

- Quench tower;
- Venturi scrubber;
- Scrubber tower;
- Demister;
- ID fan; and
- Duct to the common stack.

Drawings and P&IDs for the PAS are provided in Appendix H.

The quench tower serves four primary purposes, including to:

- Cool the AFB exhaust gas to protect downstream PAS devices.
- Provide a contact chamber for PM and acid gas removal.
- Saturate the exhaust gas to optimize the performance of the venturi scrubber.
- Rapidly decreases exhaust gas temperature to reduce the potential for PIC formation in the PAS.

Exhaust gases travel from the AFB to the quench tower where they move through a series of Brine sprays that cool the gases using evaporating water. Brine from the scrubber tower reservoir is supplied to the quench tower by the quench Brine pump and is sprayed into the top of the tower at a rate in excess of the maximum expected evaporation load. The excess water drains from the quench tower back to the scrubber tower reservoir. The quench Brine pump discharges through strainers where large PM are removed. Water required to maintain the level in the scrubber tower reservoir is added to the Brine pump discharge upstream from the quench tower spray nozzles.

The saturated exhaust gas stream will exit the quench tower and enter the high-energy venturi scrubber, which is designed for high-efficiency PM and acid gas removal. The exhaust gas stream contacts a controlled flow of Brine to form droplets that coalesce or combine in the venturi scrubber throat to remove sub-micron PM and neutralize acid gases. The venturi scrubber has a variable throat controller that may be set within the range of 20 to 50 inWC across the throat. Sodium hydroxide (18 % NaOH) is added to the Brine as required to maintain a pH ≥ 7.0 in the scrubber tower reservoir. Exiting the venturi scrubber, the exhaust gas stream flows through a 90-degree elbow before entering the scrubber tower reservoir. As the stream traverses the elbow, PM and water droplets are forced to the duct bottom and drain into the reservoir.

The two-phase effluent (gas and liquid) from the venturi scrubber enters the scrubber tower. The liquid falls to the scrubber tower reservoir while the gas rises through the chimneys of the clean liquor tray. The clean liquor pump circulates clean liquor from the bottom of the clean liquor tray to the top of the packing. The rising gas contacts this scrubbing solution in the packed bed, and acid gases are absorbed by the solution and neutralized. Circulation of solution is controlled to ensure adequate contact between liquid and gas at the maximum expected gas flow. Gases rising from the packed bed pass through a mist eliminator, which causes liquid droplets to coalesce and drain to the reservoir tray in the packed bed.

Clean liquor pH is adjusted by adding 18 % NaOH. When water or NaOH is added, excess clean liquor overflows the clean liquor tray through the chimneys and falls into the scrubber tower reservoir where it mixes with the Brine solution. This Brine is circulated back to the venturi scrubber and quench tower. The pH readings of the quench Brine and the clean liquor are recorded by PDARS.

Density is monitored in the pump discharge lines of the Brine loop and the clean liquor loop. The density meter in the Brine loop generates a proportional signal that modulates a control valve to transfer Brine to the holding tanks in the Brine Reduction Area. As Brine is discharged, process water is added to maintain the liquid level and decrease the density. The transfer of Brine continues until the density drops below the setpoint. Water is also added to the clean liquor loop to reduce density. The added water causes the fluid levels to rise and overflow the chimneys into the scrubber tower reservoir. The density of the Brine and clean liquor are recorded by PDARS. (As previously discussed, Brine is managed as an F999 waste as described in the TOCDF RCRA Permit WAP.)

Exhaust gases leave the scrubber tower and enter the demister to complete the removal of entrained solids and liquid droplets. The gas enters from the bottom and flows upward through and around candles that strip entrained moisture and solids. The solids remain on the candles while the liquid accumulates in the vessel bottom and is pumped to the scrubber tower reservoir. The MPF PAS includes a dedicated demister and a spare shared with the DFS. The spare is located between the MPF PAS and the DFS. The spare demister can be used by one incinerator at any time. The spare allows periodic replacement of the demister candles without significantly affecting operations. An atmospheric bleed damper is located just before the demister to prevent the ID fan from overheating during startup when the incinerator cannot tolerate high airflows. This damper is manually locked closed and covered during agent operations.

Exhaust gases travel from the demister to the ID fan, which is the prime mover of exhaust gases through the system. In conjunction with its suction side damper, this fan controls the pressure inside the incinerator. The pressure is sensed at the PCC and controlled at a negative pressure with respect to the MPF primary chamber furnace room. The PCC differential pressure sensor modulates the damper on the suction side of the fan. Once through the ID fan, the exhaust gases are above atmospheric pressure as they enter the duct to the common stack manifold and into the common stack. The O_2 and CO CEMS, the MPF Duct ACAMS, and the sampling ports used for the ATB are located in the duct between the ID fan and the common stack.
The operating information for major PAS components are the:

- Quench Tower - The quench tower is 6 ft in diameter and 40 ft high with a conical top and bottom. It contains spray nozzles to cool and saturate the exhaust gases. The gas outlet temperature will be approximately 200 °F, and the total Brine flow rate to all nozzles will be about 90 gpm. The quench tower drains to the scrubber tower reservoir.

- Venturi Scrubber - The venturi scrubber is an Anderson 2000, Inc., variable-throat venturi. The Brine flow rate to the venturi quench is about 120 gpm. The differential pressure across the MPF PAS venturi scrubber is normally about 20 to 30 inWC. The scrubber solution to the venturi scrubber will be pH controlled with 18 % NaOH. The pH setpoint will be maintained at ≥ 7.0.

- Scrubber Tower - The scrubber tower is 5 ft 6 inches in diameter and 40 ft high with a conical top and bottom, and it performs three functions. First, a nominal 135-ft^3 Brine reservoir is located at the bottom. A minimum of 20 inches of Brine is maintained in the reservoir to ensure adequate prime for the quench Brine pumps. Second, the midsection holds a clean liquor reservoir and a packed bed of pall rings. Clean liquor flows over the pall rings to remove acid gases and PM from the exhaust gases. Clean liquor flow to the packed bed chimneys is about 500 gpm. Third, a mist eliminator, located at the top, removes entrained moisture from the gases as they exit the tower.

- Demister - This cylindrical fiberglass vessel is 11 ft in diameter and 31 ft high with a conical bottom. It contains multiple candle structures that remove moisture and entrained solids from the gas stream passing up through them. The moisture falls to the bottom of the demister and is pumped to the scrubber tower reservoir. The MPF and DFS share a spare demister to allow candle change out with minimal impact on operations.

- ID Fan - The MPF incineration system prime mover is a two-stage, Robinson Industries, Inc., Model 5800, centrifugal fan. The fan is designed to maintain a negative pressure in the incinerator and PAS, and it is rated for an inlet gas flow of 19,000 acfm at 171°F with an ID of 99.1 inWC. Two 300 hp induction motors drive the stages of the fan.

- Quench Brine System - The quench Brine system is the network of pumps, valves, and piping that collect drainage from the quench tower, venturi scrubber, and demister and direct it into the scrubber tower reservoir. Two 300-gpm Brine pumps and a 24-gpm demister water return pump move Brine through the system to provide sprays in the quench tower and scrubber solution for the venturi scrubber. The system also controls Brine pH and density through its instrumentation and control valves.

- Clean Liquor System - The clean liquor system is the network of pumps, valves, and piping that provide the clean liquor solution for the packed bed chimneys in the scrubber tower. One of two 1,070 gpm clean liquor pumps draws clean liquor from the trays beneath the chimneys and discharges it over the tops of the packed beds. The system also controls clean liquor pH and density through its instrumentation and control valves.

2.11 CONSTRUCTION MATERIALS

The construction materials for the incinerator system components are listed in Table 2-2.

TABLE 2-2. MPF CONSTRUCTION MATERIALS

COMPONENT	CONSTRUCTION MATERIAL
Primary Combustion Chamber	Refractory-lined carbon steel; walls lined with ceramic fiber block
Combustion Air Blower	Carbon steel
Afterburner	Refractory- (alumina 35-45 %, amorphous silica 35-50 %) lined carbon steel
Quench Tower	Hastelloy® C
Venturi Scrubber	Hastelloy® C
Scrubber Tower	Hastelloy® C
Demister	Fiberglass-reinforced plastic with Nexus coating
Induced Draft Fan	Type 316 stainless-steel hub and shaft, ASTM A 240 Alloy 255 wheel, epoxy-coated carbon-steel housing
Quench Brine Pumps	Hastelloy® C
Clean Liquor Pumps	Type 316 stainless steel
Demister Water Return Pump	Type 316 stainless steel

2.12 TEMPERATURE, PRESSURE, FLOW INDICATING AND CONTROL DEVICES

This section provides a general description of temperature, pressure, flow, and other instrumentation necessary to ensure compliance with all permit conditions. A discussion of the major controls of the MPF is also provided. The locations of the process control instruments are depicted on the drawings provided in Appendix H, which also shows the instruments that are used to monitor plant operations and record data for the facility operating record and the trial burn. In addition, Appendix H includes listings of the alarm settings for key process monitoring equipment.

The control system has a centralized control console, including closed-circuit television monitors for observing operations at various locations, and locally-mounted PLCs. Most processing and sequencing operations are controlled automatically through the PLCs, and interlocks are provided to prevent improper facility operation. The PLCs monitor the interlocks and check for any failure to complete a programmed step. Abnormal conditions, operator entries into the system, and starting and stopping of equipment are logged with the time of occurrence by PDARS. The control system provides continuous automatic control of the incineration process. In monitoring critical functions, the process control system gives advanced warnings using pre-alarms where possible to indicate that an alarm condition is developing and warn operators in time to take preventive action.

The proper operation of this monitoring and control equipment is necessary to ensure consistent compliance with all permit conditions and safe and efficient operation of the MPF. Although all process monitoring instrumentation receives periodic maintenance, equipment critical to compliance with permit operating conditions receives additional attention. Key issues associated with these instruments include:

- Continuing and preventive maintenance;
- Verification of instrument calibration; and
- Verification of AWFCO integrity.

The preventive maintenance program is supported by information received from daily and periodic inspections of the process and equipment. Instrument calibration and preventive maintenance is performed following the procedures and frequencies shown in Table 2-3. A description of the most significant control loops follows.

2.12.1 PCC Feed Rate Control

The progression of trays bearing bulk containers, munitions, or miscellaneous waste into the MPF PCC is controlled by software installed in the PLC and keyed to the tray number. Each waste type has a unique number series (i.e., waste trays are 900 series numbers, TCs are 100 series numbers, and projectiles are 200 and 600 series numbers). The tray number allows the PLC to set the interval at which trays can be charged into Zone 1. Each waste type has its own set of zone times built into the programming to control the movement of trays between zones. Interlocks from the tray tracking system prevent mixing waste types. To further protect against inadvertent charging, the conveyors are interlocked to prevent either advancing a tray into the MPF unless Zone 1 is empty, or advancing a tray unless the discharge airlock is empty.

TABLE 2-3. PROCESS INSTRUMENTS CALIBRATION FREQUENCY

ITEM	INSTRUMENT TAG IDENTIFICATION	INSTRUMENT	CALIBRATION FREQUENCY (days)
1	14-TIT-152, 14-TIT-391	PCC Temperature, Zone 1	180
2	14-TIT-141, 14-TIT-392	PCC Temperature, Zone 2	180
3	14-TIT-153, 14-TIT-393	PCC Temperature, Zone 3	180
4	14-PIT-070	PCC Pressure	180
5	14-PSHH-034	PCC Pressure Switch High-High (AWFCO)	180
6	14-TIT-065, 14-TIT-069	Afterburner Temperature	180
7	24-FIT-9667	Afterburner Exhaust Gas Velocity	360
8	24-PIT-9667	V-Cone Pressure	180
9	24-TIT-9667	V-Cone Temperature	180
10	24-TIT-509	Quench Tower Exhaust Gas Temperature	90
11	24-TSHH-223	Quench Tower Exhaust Gas Temperature High-High	360
12	24-PDIT-222	Venturi Scrubber Differential Pressure	360
13	24-FIT-218	Brine Flow to Venturi Scrubber	180[1]
14	24-PIT-233	Quench Brine Delivery Pressure	180
15	24-FIT-248	Clear Liquor Flow to Scrubber Tower Sprays	180[1]
16	24-PIT-258	Clear Liquor Delivery Pressure	180
17	24-DIT-216	Quench Brine Density	180[2]
18	24-AIT-224A & B	Quench Brine pH	7
19	14-AIT-384	Exhaust Gas CO Concentration	Daily[3]
20	24-AIT-669	Exhaust Gas CO Concentration	Daily[3]
21	14-AIT-082	Exhaust Gas O_2 Concentration	Daily[3]
22	24-AIT-670	Exhaust Gas O_2 Concentration	Daily[3]
23	PAS 703G	PAS Blower Exhaust Gas Agent GB Concentration	24 hr [4]
24	PAS 703V	PAS Blower Exhaust Gas Agent VX Concentration	4 hr [4]
25	PAS 703H	PAS Blower Exhaust Gas Mustard Agent Concentration	24 hr [4]

TABLE 2-3. PROCESS INSTRUMENTS CALIBRATION FREQUENCY (continued)

ITEM	INSTRUMENT TAG IDENTIFICATION	INSTRUMENT	CALIBRATION FREQUENCY (days)
26	PAS-701G/706V/707H	Common Stack Exhaust Gas Agent Concentration	Daily [4] 4 hr for VX
27	23-LSHH-002, -006, -702, -706	BRA-TANKS Level Indicator	360 [5]
28	14-TIT-010	PCC Exhaust Gas Temperature	360[6]
29	24-DIT-249	Clean Liquor Density	180[2]
30	24-AIT-247A & B	Clean Liquor pH	14
31	24-PDIT-225	Packed Bed Scrubber Differential	360
32	49-WIT-152	Load Cell, BDS-101	360
33	49-WIT-252	Load Cell, BDS-102	360

[1]Preventive Maintenance Schedule. The transmitter is calibrated by an internal frequency generator.
[2]Preventive Maintenance Schedule. Density instrument calibration is indicated by a manufacturer's certificate.
[3]The CEMS are managed as specified in Attachment 20 to the RCRA permit (3).
[4]The ACAMS are managed as specified in Attachment 22 to the RCRA permit(7).
[5]Preventive Maintenance Schedule. Switches are function checked for fluid/no fluid at sensor indication.
[6]This instrument is calibrated at a different frequency because it doesn't measure a regulated operating parameter.

2.12.2 PCC Zone Exhaust Gas Temperature and Burner Controls

Thermocouples 14-TE-152 and 14-TE-391; 14-TE-141 and 14-TE-392; and 14-TE-153 and T14-TE-393 are located in Zones 1, 2, and 3, respectively, and they monitor zone temperatures. Transmitters 14-TIT-152 and 14-TIT-391; 14-TIT-141 and 14-TIT-392; and 14-TIT-153 and 14-TIT-393 transmit the thermocouple outputs to 14-TY-152, 14-TY-141, and 14-TY-153, respectively, where the zone temperatures are calculated as the average of the two thermocouples in each zone. The averages become inputs to temperature controllers 14-TIC-152, -141, and -153 to control the respective zone burners' firing rates by modulating gas control valves for the appropriate burners to maintain PCC exhaust gas temperature at 1,450 °F for TCs and 1,600 °F for munitions. Combustion air is supplied at a fixed rate. (Valve numbers are listed in detail "A" of drawing TE-1-D-530 included in Appendix H.)

The averaged temperatures also initiate water sprays in Zones 1 and 2 when the zone temperatures exceed the setpoint. For Zone 1, the calculated average temperatures measured in the crossover duct by 14-TIT-010 and in Zone 1 by 14-TIT-152 and 14-TIT-391, are input to controller 14-TIC-152A to activate water spray. Controller 14-TIC-141A activates Zone 2 water spray based on the calculated average temperature as measured by 14-TIT-141 and 14-TIT-392. Low-low PCC exhaust gas temperature indicators 14-TIT-152 and 14-TIT-391; 14-TIT-141 and 14-TIT-392; and 14-TIT-153 and 14-TIT-393 activate alarms 14-TALL-152; 14-TALL-141; and 14-TALL-153, respectively, and an AWFCO if the PCC temperature on an HRA basis falls below the setpoint in the respective zone. These same temperature instruments also sense high

PCC zone temperatures and will activate an alarm and an AWFCO if the zone temperature rises above 1,800 °F. Indicators 14-TIT-71, 72, and 79 provide temperature input to the Flame Safety Shutdown System (FSSS) to allow starting and operating burners. Using these indicators, the FSSS also protects the PCC by locking out all burners if a zone extreme temperature limit is reached. A continuous record of all the temperatures discussed above is maintained by PDARS.

2.12.3 Afterburner Temperature and Burner Control

The AFB gas temperature is measured by means of thermocouples 14-TE-065 and 14-TE-069 located in the AFB walls. Temperature indicators 14-TIT-065 and 14-TIT-069 process the thermocouple outputs to 14-TY-065, which calculates the average temperature and transfers the data to temperature controller 14-TIC-065. The output from 14-TIC-065 is sent to the input of the fuel gas flow controllers, which modulate the firing rate of the burners and control the average AFB exhaust gas temperature. The combustion airflow valves 14-FV-402 and -422 are modulated to maintain sufficient excess air. Thermocouple 14-TE-087 provides process temperature input to the FSSS to allow starting and operating burners.

Additional temperature control is provided by ramping open dilution air control valves 14-FV-500A and B if AFB temperature, as measured by 14-TIC-065, reaches 2,050 °F. Opening the dilution air valves adds excess oxygen to the AFB to assist in combustion and cooling the AFB. If the 14-TIC-065 temperature exceeds 2,075 °F, all PCC burners except for #3 (Zone 1), #6 (Zone 2), and #10 (Zone 3) are shutdown. Should the 14-TIC-065 temperature exceed 2,250 °F, burners #3, #6, and #10 would shutdown, the AFB burners would be shutdown, and the AFB combustion air dampers would be driven to 25 % flow.

Low-low temperature switch 14-TSLL-065 and high-high temperature switch 14-TSHH-065 activate alarms and AWFCOs if the AFB exhaust gas temperature on an HRA basis falls below 1,800 °F or rises above 2,175 °F. Temperature switch 14-TSHH-087 is set at the AFB extreme temperature limit and causes a lockout of all burners at 2,400 °F.

Continuous temperature recording of the aforementioned instruments is provided by PDARS.

2.12.4 PCC Pressure Control

The differential pressure between the MPF furnace room and the PCC is monitored constantly by pressure transmitters 14-PDIT-034 and 14-PDIT-070, which are mounted near the top of the PCC. Pressure controller 14-PIC-070 drives 14-PV-070, located near the suction of the MPF ID fan, to maintain the PCC at 5 inWC more negative than the MPF furnace room. 14-PDIT-034 feeds high-high PCC pressure switch 14-PSHH-034, which activates alarm switch 14-PAHH-034 and an AWFCO if the differential pressure between the MPF furnace room and the PCC rises to -0.1 inWC for more than one minute. A continuous record of the PCC pressure is maintained by PDARS through 14-PIC-070 and 14-PAHH-034.

2.12.5 MPF Secondary Cooling Water Controls

Water is used in the Secondary Cooling Water System (SCW) which is a closed-loop system that circulates water to cool the MPF discharge airlock door (discussed in Section 2.1). Heat is transferred from the door to the cooling water and through a plate heat exchanger to the MDB-wide primary cooling system. A pressure safety valve lifts at 50 pounds per square inch gauge (psig) to provide overpressure protection for the door and associated piping by venting pressure to the atmosphere. The MPF secondary cooling water expansion tank SCW-TANK-101 maintains a slight pressure head on the system and is manually refilled from the process water system if makeup is needed. Indicator 61-LSH-227 is set at 1 ft 6 inches above the tank bottom and activates a high-level alarm if that level is exceeded. Indicator 61-LSL-226, set at 6 inches, activates a low-level alarm if the level is declining. If SCW-TANK-101 drops to 3 inches, 61-LSLL-606 stops feed to the MPF and interrupts the Zone 3 timer to prevent cycling the airlock door. The timer does not reset; it resumes when level is restored. The SCW-TANK-101 outlet temperature is sensed by 61-TIT-229, which generates an alarm at 150 °F.

Circulation pumps SCW-PUMP-101 and -102 are redundant and provide forced circulation of the water through the door coils. Hand switches are field-mounted for selection of either local or remote control of the pumps. In the remote mode, the pump can be manually operated by the Control Room Operator or automatically by the PLC. Pump and local/remote status is indicated in the Control Room, including alarms to alert the operator that the selected pump failed to start or automatic transfer failed to occur. Indicator 61-PIT-223, located near the pump outlet, provides pressure indication and generates an alarm at 35 psig. This condition starts the standby pump and stops the primary pump. If the pump outlet pressure drops to 30 psig, 61-PSLL-222 initiates a low-low-pressure alarm, stops feed, stops the Zone 3 timer, prevents raising the Zone 3 door or unclamping the discharge airlock exit door, and shuts down both MPF secondary cooling water pumps. Indicator 61-FIT-267 measures coolant flow, and 61-FAL-267 triggers an alarm if the flow is ≤ 80 gpm. The outlet temperature from the secondary water exchanger SCW-EXCH-101 is sensed by 61-TIT-233, which generates an alarm at 130 °F. If the cooling water pressure to the door exceeds 45 psig, secondary water is automatically circulated to SCW-TANK-101 through a regulator valve.

2.12.6 Quench Outlet Gas Temperature

The quench outlet gas temperature is measured by means of thermocouple 24-TE-509. The temperature is fed through temperature indicator 24-TIT-509 to PDARS for continuous process monitoring. Pre-alarm 24-TAH-509 will activate if 200 °F is detected in the quench outlet duct. If quench exit temperature reaches 225 °F, 24-TSHH-223 will trigger an AWFCO. Temperature sensor 24-TSHH-223 and 24-TAHH-509 also cause emergency quench spray valve 24-TV-223 to open at 225 °F. Detection of 250 °F by 14-TSHHH-509 or -510 automatically shuts down the MPF PCC and AFB burners.

2.12.7 Quench Brine Flow

Brine flows to the quench tower sprays are measured with a magnetic flow meter, 24-FE-217. Flow indicating controller 24-FIC-217 uses input from the flow meter to modulate control valve 24-FV-217 to ensure proper flow to the quench tower. It also provides input to PDARS for continuous process monitoring. Low-flow alarm 24-FAL-217 provides warning in the Control Room if quench Brine flow falls below 60 gpm.

2.12.8 Quench Brine Delivery Pressure

Adequate Brine delivery pressure is essential to the proper operation of the quench tower and the venturi scrubber. Instrument 24-PIT-233 monitors the discharge pressure of the operating centrifugal Brine pump, PAS-PUMP-102 or 103, and provides input to PDARS for continuous process monitoring. Should pressure fall to 70 psig, 24-PALL-233 would alarm and actuates an AWFCO.

2.12.9 Venturi Scrubber Brine Flow

Brine is sprayed radially and tangentially into the venturi scrubber. The Brine flow rate is measured by the magnetic flow meter 24-FE-218. Flow indicating controller 24-FIC-218 uses data from 24-FE-218 to modulate control valve 24-FV-218 to ensure proper Brine flow to the venturi scrubber. Brine flow data are provided to PDARS for continuous process monitoring. Low flow alarm 24-FAL-218 actuates an AWFCO if flow falls below the setpoint on an HRA basis.

2.12.10 Brine pH

Brine pH is monitored by means of alternating pH analyzers 24-AE-224A and 224B. Indicating controller 24-AIC-224 modulates control valve 24-AV-224 to adjust the addition of caustic to maintain the desired pH and provides input to PDARS for continuous process monitoring. Low-low pH alarm 24-AALL-224 activates an AWFCO if pH falls below the setpoint on an HRA basis.

2.12.11 Brine Density

Brine density is monitored by means of density meter 24-DE-216. Indicating controller 24-DIC-216 modulates control valve 24-DV-216 to transfer Brine to the Brine holding tanks while 24-LV-245 opens to introduce process water to the system, thus reducing overall Brine density. The same controller also provides input to PDARS for continuous process monitoring. High-high density alarm 24-DAHH-216 activates an AWFCO if Brine specific gravity increases above the setpoint on a 12-hr rolling average basis.

2.12.12 Venturi Scrubber Differential Pressure

Pressure indicator 24-PDIT-222 measures the differential pressure across the venturi scrubber. Indicating controller 24-PDIC-222 provides input to PDARS for process monitoring. The same PDIC provides high and low differential pressure alarms 24-PDAH-222 and 24-PDAL-222. An AWFCO is initiated if the differential pressure falls below 20 inWC on an HRA basis.

2.12.13 Scrubber Tower Sump Level Control

The scrubber tower sump level is measured by means of level indicating transmitter 24-LIT-245. Indicating controller 24-LIC-245 provides input to PDARS for continuous level monitoring. The same indicating controller provides high- and low-level alarms 24-LAH-245 and 24-LAL-245, respectively. It also controls level in the scrubber tower sump by modulating valve 24-LV-245 to adjust the quantity of process water added to the quench tower sprays. If a low-low level is detected, low-low level alarm 24-LALL-246 will be activated. If a high-high level is detected, alarm LAHH-246 will be activated. If either the low and low-low level alarms or the high and high-high level alarms are simultaneously activated, the PCC and AFB burners will automatically shutdown. Additionally, if LAHH-244 is activated, all liquid inputs to the scrubber sump, other than Brine spray, are isolated.

2.12.14 Clean Liquor Flow Control

Clean liquor is pumped to the top of the packed bed scrubber and distributed evenly over the pall rings by distribution trays. The flow rate is measured by magnetic flow meter 24-FE-248. Flow indicating controller 24-FIC-248 uses data from flow meter 24-FE-248 to modulate control valve 24-FV-248 to ensure proper circulation of liquor from the chimney tray to the top of the packed bed. The 24-FIC-248 provides input to PDARS for continuous process monitoring. Low-low flow alarm 24-FALL-248 activates an AWFCO if flow falls below the setpoint on an HRA basis.

2.12.15 Clean Liquor Delivery Pressure

Adequate clean liquor delivery pressure is essential to the proper operation of the scrubber tower. Pressure indicator 24-PIT-258 monitors the discharge pressure of the operating centrifugal clean liquor pump, PAS-PUMP-104 or -105, and provides input to PDARS for continuous process monitoring. Should pressure reach 25 psig, 24-PALL-258 would alarm and actuate an AWFCO.

2.12.16 Clean Liquor Level Control

Scrubber tower chimney tray level is measured by means of level indicating transmitter 24-LIT-243. Indicating controller 24-LIC-243 provides input to PDARS for continuous level monitoring and the low-level alarm 24-LAL-243. It also controls level in the chimney tray at > 55 inches by modulating valve 24-LV-243 to adjust the quantity of process water added to the clean liquor discharge. If a low level is detected, low-level alarm 24-LAL-243 will be activated.

2.12.17 Clean Liquor pH Control

Clean liquor pH is monitored by means of alternating pH analyzers 24-AE-247A and 247B. Indicating controller 24-AIC-247 modulates control valve 24-AV-247 to adjust the addition of caustic to maintain the desired pH and provides input to PDARS for continuous process monitoring. The alarms 24-AAD-247, 24-AAH-247, 24-AAL-247, and 24-AALL-247 provide alarms to alert the operator should pH rise or fall outside of the desired range or if the difference in pH between the analyzers is unacceptable. This parameter is a MACT alarm that is activated by a 12-hour rolling average.

2.12.18 Clean Liquor Density Control

Clean liquor density is monitored by means of density meter 24-DE-249. If indicating controller 24-DIC-249 senses density in excess of desired values, it overrides level controller 24-LIC-243 to open control valve 24-LV-243, which increases the flow of process water to the packed beds, thus reducing overall clean liquor density. The same controller also provides input to PDARS for continuous process monitoring. High-density alarms 24-DAH-249 and 24-DAHH-249 alert the operator if clean liquor specific gravity rises above the desired value. This parameter is a MACT alarm that is activated by the 12-hour rolling average.

2.12.19 Demister Level Control

The exhaust gas exits the scrubber tower and flows into the demister to remove any remaining water droplets and PM. Liquids and entrained particles drain to the vessel sump. Over time, the sump level increases and must be drained from the vessel. The liquid level is monitored by level indicating transmitter 24-LIT-293 and controlled by level indicating controller 24-LIC-293. The 24-LIC-293 also provides continuous level input to PDARS. When the liquid level reaches 14 inches, MPF demister water return pump PAS-PUMP-137 is energized and 24-LIC-293 modulates control valve 24-LV-293 to lower the level to 10 inches by directing flow to the scrubber tower sump. To avoid constant cycling of PAS-PUMP-137, liquid is continuously circulated to the demister through pressure control valve 24-PCV-759 when not pumping liquid to the scrubber tower sump. High-, high-high-, and low-level alarms are also provided from 24-LIC-293. Low-low level switch 24-LSLL-294 provides an alarm and causes shutdown of PAS-PUMP-137 and MPF demister empty-out pump PAS-PUMP-118 to protect against operating the pumps with an empty sump. Similarly, high-high level switch 24-LSHH-292 alerts the operator to take action before the candles are flooded. Equivalent instrumentation and control valves are provided for the spare demister.

2.12.20 Demister Candle Pressure Drop

The PM carried by the exhaust gas into the demister becomes embedded in the candle filter elements. Over time, these particles increase the pressure drop across the candles and limit their effectiveness. Eventually, replacement of the pre-filter or candle filter elements is required. Differential pressure indicating transmitter 24-PDIT-291 senses the pressure drop, while 24-PDI-291 provides continuous pressure drop input to PDARS and provides alarms when the pressure drop increases to unacceptable values. High differential pressure alarm 24-PDAH-291 alerts the operator that the filter elements require cleaning. Should no action be taken, high-high differential pressure alarm 24-PDAHH-291 would cause feed to the furnace to stop. Equivalent instrumentation is provided for the spare demister.

2.12.21 MPF Bleed Air Valve Operation

The MPF exhaust blowers require a minimum flow at all times to cool the fan wheels and prevent thermal distortion. During startup and periods of extended idle, turndown conditions are extreme and necessitate augmenting combustion gas flow with outside air to provide minimum blower flow. This is accomplished by using manual controller 24-HIC-751 to open 24-HV-751 and introduce outside air. Valve 24-HV-751 must be completely closed before agent feed can begin. In addition, the air intake to 24-HV-751 must be capped before agent feed may begin; this ensures that no path exists for agent migration to the atmosphere and to prevent inadvertent dilution of the emissions being monitored.

2.12.22 MPF Exhaust Gas O_2 Concentration

Oxygen monitor 14-AIT-033 determines the O_2 concentration in the crossover duct between the PCC and the AFB to indicate process conditions inside the PCC. Should concentration fall outside the range of 3 % to 15 %, alarms alert the furnace operator. Oxygen concentrations and alarm statuses are provided continuously to PDARS.

Section 2.12.3 discusses how 14-FV-500A and B add excess air to the AFB to assist in its cooling. Combustion air can also be added to ensure that the AFB oxygen concentration remains above 8 % to aid combustion. At 8 %, output from high-speed oxygen-analyzer controller 14-AIC-082B in the AFB exhaust energizes 14-FV-500A and B to admit air through two ducts into each side of the AFB. The airflow is increased every 5 min until 8 % oxygen is achieved.

The MPF exhaust gas O_2 concentrations are measured continuously by O_2 analyzers 14-AIT-082 and 24-AIT-670. Oxygen concentrations are also displayed and provided continuously to PDARS by 14-AIT-082 and 24-AIT-670. If the O_2 concentration is below the preset low-low level setpoint, alarms 14-AAL-082 and 24-AAL-670 are activated, and an AWFCO is initiated. If the O_2 concentrations are above the high-high level setpoint, alarms 14-AAH-082 and 24-AAH-670 are activated and an AWFCO is initiated.

2.12.23 MPF Exhaust Gas CO Concentration

The MPF exhaust gas CO concentrations are measured continuously by CO analyzers 14-AIT-384 and 24-AIT-669. These analyzers display results locally and provide continuous CO data to PLCs. The PLCs calculate a 1-min average and an HRA, corrected to 7 % O_2 dry volume, which is compared to the RCRA/MACT limit of 100 ppmdv. If the CO concentrations are above the limit, alarm 14-AAH-384 or 24-AAH-669 is activated and an AWFCO is initiated. The averages are stored by PDARS.

2.12.24 MPF Exhaust Gas Mustard Concentration

The MPF exhaust gases in the MPF Duct are continuously monitored for mustard agent by ACAMS PAS 703. Normal operation will use an ACAMS for mustard agent in the MPF Duct, with a backup ACAMS provided. Three ACAMS will be used to monitor mustard agent exhaust gas concentrations in the MPF Duct during the ATB. Mustard agent is monitored at the common stack by ACAMS PAS 707a, 707b, and 707c. For both locations, two ACAMS are online to ensure continuous monitoring of agent while the third ACAMS is in the standby mode. One ACAMS will be sampling while the second ACAMS is in the purge/analysis mode. If the ACAMS detect mustard agent concentrations greater than the setpoint specified in Appendix D, an AWFCO is initiated, and both audio and visual alarms are activated. The DAAMS tubes will be changed hourly during the ATB, and the CAL will analyze the collected DAAMS tubes.

Before a tray can be transferred out of the MPF discharge airlock, it must be verified free of agent. The purge air discussed in Section 2.1 is sampled for agent by ACAMS AL-468 to ensure that complete thermal decontamination has been achieved. Air flows from the MPF room, through the MPF discharge airlock, to the ACAMS, and finally to the AFB. If the sample results are negative (i.e., no agent detected), the tray is transferred from the MPF discharge airlock to the MPF discharge tray unloading conveyor. If agent contamination is detected, the discharge airlock door clamp is interlocked from unclamping, and the tray is returned to Zone 3 for further processing. (One zone is left empty during agent monitoring of the tray in the discharge airlock.) If the ACAMS monitor is offline or in calibration, the airlock purge timer is interrupted, trays are interlocked from transferring within the furnace, and the discharge door cannot be opened. When the ACAMS is restored to normal, the timer resumes timing, and the system operates normally.

2.12.25 MPF Exhaust Gas Flow Rate

Exhaust gas flow rates for the MPF are measured with a V-Cone® flow meter 24-FIT-9667. The flow meter is installed in the exhaust duct located after the scrubber tower and before the demister to measure the volumetric flow rate. The V-Cone® is positioned in the center of the duct to increase the velocity of the exhaust flow, which creates a differential pressure. The pressure difference is measured and converted to standard cubic feet per minute (scfm) flow rate.

The MPF control system records the value and generates an HRA. If the HRA setpoint is exceeded, an AWFCO is initiated and both audio and visual alarms are activated.

2.13 INCINERATION SYSTEM STARTUP PROCEDURES

This section discusses the startup procedures as required by 40 CFR 270.62(b)(2)(vii). The MPF is brought to full operating condition while firing natural gas before any hazardous wastes are introduced into the PCC. Full operating condition means that combustion temperatures are above the minimum for feeding waste, the MPF PAS is operational, the MPF is under vacuum, and the unit is in compliance with all regulatory limits. The startup sequence is performed in reverse order of the direction that waste feed and combustion products pass through the system; i.e., the PAS is started first, and the waste feed systems last. Before any of the MPF processing equipment can be started, all utilities and control systems must be operational. The typical time required for startup from a cold system will be about 30 hr. A test of the AWFCO system will be performed before agent is fed to the system, and the DAQ and DSHW will be notified 7 days in advance of the test to allow them to observe the test.

A summary of the MPF startup procedures is presented in the following subsections.

2.13.1 Startup Utilities

The successful startup steps for the utility systems follow the sequence outlined below:

1. Provide electrical power to the main switchgear, the motor control centers, and the control room.
2. Place the Uninterruptible Power Supply (UPS) in operating mode.
3. Place the emergency power generator in standby mode.
4. Start all PLCs associated with MPF operation.
5. Start the plant and instrument air systems.
6. Start the fuel gas system.
7. Start the process water system.
8. Start the caustic system.
9. Start the MDM or BDS systems to drain munitions or containers for decontamination.
10. Start the conveyor system to transport the munitions.
11. Ensure that at least one Brine surge tank has sufficient volume for sustained operations.
12. Perform a pre-operational check of all systems to be used.

2.13.2 Startup the MPF PAS

The successful startup steps for the MPF PAS follow the sequence outlined below:

1. Before MPF PAS startup:
   a. Check that the quench tower sump is empty, any debris left from earlier operations is removed, and all manways are securely in place.
   b. Check that caustic is lined up to provide Brine and clean liquor pH control.
   c. Confirm that Brine and clean liquor densities are at acceptable values. If not, add process water to the system and drain to a Brine surge tank as necessary to achieve an acceptable density.
   d. Confirm that the scrubber tower sump level is within acceptable limits.
   e. Remove the bleed air damper cover.
   f. Check that the exhaust blower lube oil system is operating and oil temperature is acceptable.
   g. Verify that the ACAMS and DAAMS are online.
   h. Verify from 14-AISH-036 that there are no fuel gas leaks to the MPF PCC room.
   i. Verify from 14-AISH-336 that there are no fuel gas leaks to the MPF SCC room.

2. Next, to start the PAS:
   a. Confirm that the demister water return pump is lined up to the scrubber tower sump, and that the demister sump level is at the controlled setpoint.
   b. Start the Brine and clean liquor pumps and adjust flow rates, as necessary. Confirm the availability of the spare pumps.
   c. Start the exhaust blower.

2.13.3 Startup the Afterburner

The successful startup steps for the AFB follow the sequence outlined below:

1. Line up fuel gas and plant air.
2. Start the combustion air blower and confirm proper combustion airflow.
3. Signal the burner management system to light the first AFB burner, followed shortly thereafter by the second burner. Monitor the burner air purge, pilot lighting , and burner lighting.
4. Place the burners in AUTO. After flame has been stabilized in either burner in the AFB, the PLC ramps up the temperature setpoint 100 °F per hour until the chamber exhaust gas reaches 2,000 °F.
5. Monitor the PLC while it brings the AFB up to operating temperature.
6. Verify that the bleed air damper is closed and the cover is installed.
7. Verify that 14-AIC-082B on the AFB exhaust is measuring and maintaining an oxygen content of 8 % in the exhaust gas.

2.13.4 Startup of the MPF PCC

The successful startup steps for the MPF PCC follow the sequence outlined below:

1. Line up valves, including fuel gas, secondary cooling water, and plant air. If necessary, fill the SCW system.
2. Signal the burner management system to light the PCC burners. Monitor the burner air purge, the pilot lighting, and the burner lighting.
3. Place the burners in AUTO and signal the PCC PLC to increase the burner gas flow to raise the PCC temperature according to the refractory heat-up program.
4. Monitor the PLC while it brings the PCC up to operating temperature.
5. Verify that the PCC and AFB reach permitted minimum operating temperatures (refer to Appendix D), and all Limiting Conditions of Operation (LCOs) and waste feed parameters are satisfied; then, the MPF is ready to receive hazardous waste.
6. Start waste feed while maintaining PCC and AFB temperatures and other system operating parameters within permit limits.

3.0 SAMPLING AND ANALYSIS PROCEDURES

The sampling and analysis objectives for the TOCDF MPF TC HD ATB are to:

- Demonstrate maximum agent feed rate and 99.9999 % DRE (99.99 % if the heel is < 90 lb) for the designated POHC, *bis*(2-chloroethyl) sulfide.

- Demonstrate control of CO emissions by maintaining the CO concentration at < 100 ppm, corrected to 7 % O_2, on an HRA basis and < 1.45 lb/hr (Title V Permit).

- Demonstrate control of PM emissions by showing that the concentration is:
  - < 29.7 mg/dscm @ 7 % O_2 (MACT Limits).
  - < 0.75 lb/hr (Title V Permit)

- Provide data regarding the emissions of metals, PCDDs/PCDFs, and other PICs for use in updating the DCD HHRA and meeting the MACT emission limits.

- Demonstrate that the PCDD/PCDF emissions are < 0.40 ng 2,3,7,8-TCDD TEQ/dscm corrected to 7 % O_2.

- Demonstrate that the emission rate of SO_2 is below the Title V limit of 1.0 lb/hr.

- Determine NO_x emissions.

- Demonstrate that the THCs emissions are < 10 ppmdv on an HRA (monitored with a CEMS), dry basis, corrected to 7 % O_2, and reported as propane equivalents.

- Demonstrate that the combined halogen emissions of HF, HCl, and Cl_2 are < 32 ppm (MACT Limits), as HCl equivalents, dry basis, and corrected to 7 % O_2.

Two test conditions using TCs will be used to meet the trial burn objectives. Condition 1 will be performed with TCs containing up to 632 lb liquid mustard and minimal solids. Condition 2 will be performed with TCs with up to a total of 632 lb heel which is mainly a solid heel covered with liquid mustard. A DRE will not be calculated from Condition 2 data because the irregularly-shaped solids prevent determination of the amount of mustard covering those solids.

The sampling and analysis procedures included in this section were selected to accomplish the objectives discussed above. Detailed information on the sampling and analysis methods is provided in the QAPP (see Appendix A), which will be referenced herein to prevent duplication of text. The PIC emissions data, including PCDDs and PCDFs, are being collected for use in updating the DCD HHRA and compliance with emission limits. The rationale for the selection of the POHCs is presented in Section 5.2.

3.1 SAMPLING LOCATIONS

Samples collected for the MPF TC HD ATB will be divided into exhaust gas samples, process stream samples, and neat mustard agent samples. Exhaust samples will be collected in the MPF Duct using seven sampling trains. Process samples will include Brine, NaOH Makeup, process water, and TC residue samples. Neat mustard agent samples will be collected from each TC and a sample of the solid heel will be collected from each TC used for Condition 2. Natural gas and combustion air will not be sampled.

3.1.1 Exhaust Gas Sampling Locations

The DFS, MPF, LIC1, and LIC2 share a common stack. This arrangement requires that the samples used to verify the performance of each furnace system be collected in the duct between the ID fan and the common stack. The parameters to be measured at this location include mustard, CO, O_2, volatile PICs, semi-volatile PICs, metals emissions, PM, THCs, PCDDs/PCDFs, CO_2, SO_2, NO_x, Cl_2, HF, and HCl.

Mustard agent is monitored at two different locations for two different purposes. The DAAMS located in the MPF Duct will be used to collect the agent data for the DRE calculations. The ACAMS in the MPF Duct will be used for stop feeds. The station number for the agent monitors are PAS 703 for the MPF (as listed in Appendix D). During the ATBs, there will be three ACAMS and two DAAMS at the MPF Duct sample location in order to sample the exhaust gas stream continuously. One ACAMS will be in the sample mode while the second ACAMS is in the analysis mode. The third ACAMS is held in reserve to replace an ACAMS if it fails.

The second location where ACAMS and DAAMS are found is in the common stack monitoring house. This ACAMS/DAAMS sample location is designated as PAS 707 for mustard (see Appendix D), and is used to activate the AWFCO system. The stack monitoring station monitors the combined gases leaving all furnace systems and is a final safety monitor of the exhaust gas leaving the stack. The stack monitoring house also has three ACAMS and one DAAMS. The PDARS records data from each station.

Additional samples to be collected in the MPF duct include seven sampling trains for sampling emission levels of different parameters. Table 3-1 lists the sampling ports associated with each sampling train for the MPF TC HD ATB. The arrangement of the MPF sampling ports is presented in Figure 3-1.

TABLE 3-1. MPF EXHAUST GAS SAMPLING SUMMARY

SAMPLING TRAIN	ANALYSES PERFORMED	LOCATION	PURPOSE
Method 1	Traverse Points	Each Port	Report Information
Method 2	Exhaust Gas Velocity	Isokinetic Trains	Report Information
Each Isokinetic Train	Exhaust Gas Moisture	Isokinetic Trains	Report Information
Method 0010	SVOC	Ports TBS-013 & TBS-014	Report Information
Method 0010-TOC	SVTOC & NVTOC	Ports TBS-011 & TBS-012	Report Information
Method 0023A	PCDD & PCDF	Ports TBS-013 & TBS-014	Report Information
Method 0031	VOC	Port TBS-018	Report Information
Method 0040	VTOC	Port TBS-015	Report Information
Method 5/0050	PM, HCl, & Cl_2	Ports TBS-016 & TBS-017	Report Information
Method 29	HHRA Metals	Ports TBS-011 & TBS-012	Report Information
ACAMS	Mustard	Common Stack	AWFCO & Report Information
DAAMS	Mustard	Common Stack	Agent Confirmation & Report Information
ACAMS	Mustard	MPF Duct ACAMS Port	Stop Feed & Report Information
DAAMS	Mustard	MPF Duct DAAMS Port	Report Information (POHC DRE)
TOCDF CEMS	O_2, CO	MPF Duct CEMS Port	AWFCOs & Report Information
CEMS	CO_2, THC, SO_2, NO_x	MPF Duct Port	Report Information

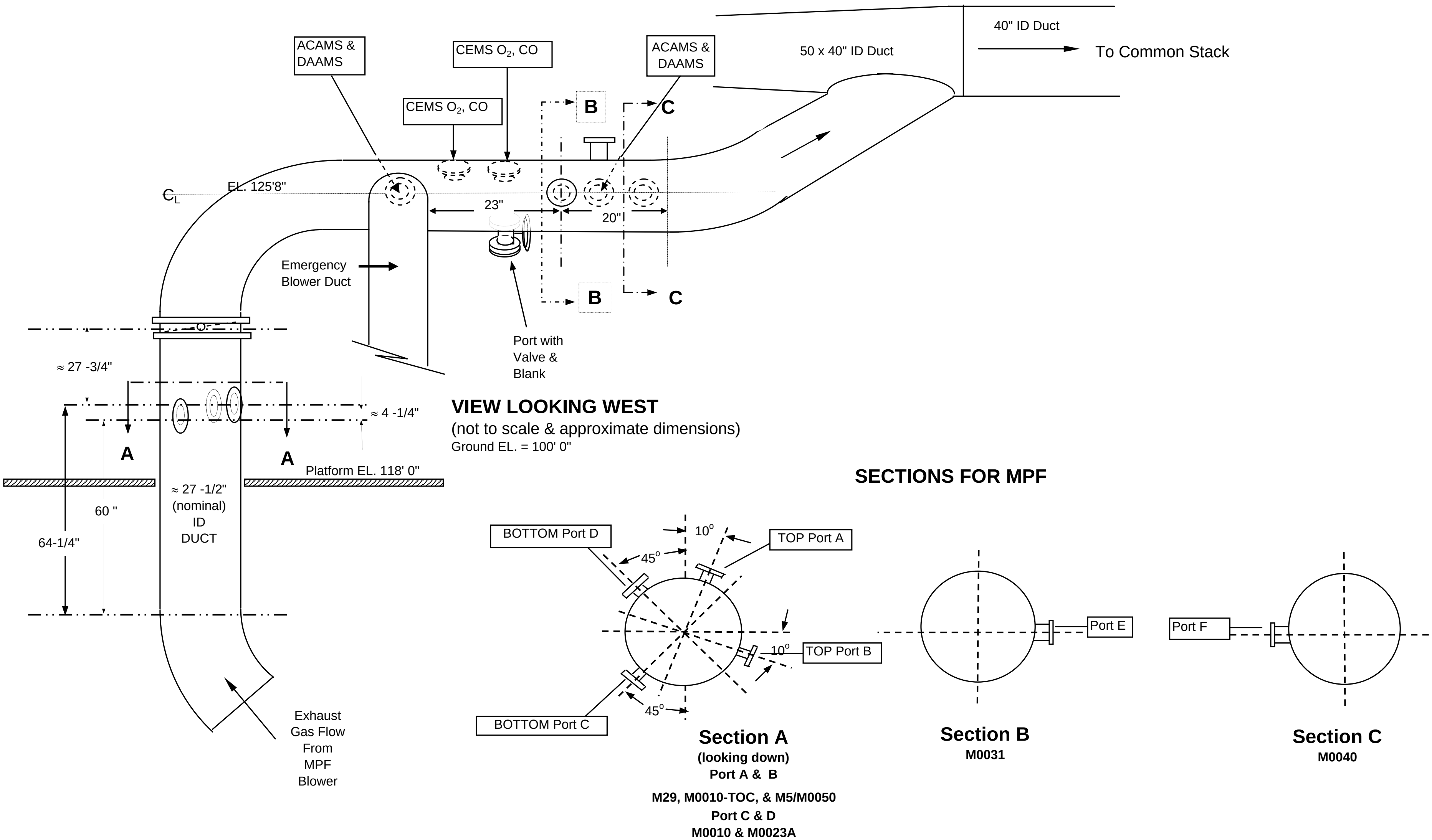


Figure 3-1. MPF Exhaust Gas Sampling Port Locations

3.1.2 Process Stream Sampling Locations

Process streams sampled as part of the MPF TC HD ATB include neat mustard agent, Brine, NaOH Makeup, process water, and residue samples. Mustard agent samples will be collected from each TC used in the ATB and this sample may be collected in Area 10 before the TC is moved to TOCDF. The Brine and NaOH samples will be taken via taps on the discharge of the pumps that are used to move the solutions. Process water samples will be collected from a water supply line in the PAS. Samples of the TC residues will be collected at the end of each run after the TCs have cooled. After collecting the residues from processed and cooled munitions, one sample of the collected residues will be taken.

3.2 SAMPLING METHODS

Samples for each run will be collected between the time the test starts and the time the test is declared complete, with the exception of the neat mustard agent samples and the residue samples. The neat mustard agent samples will be collected from each TC before the ATB begins. The residue samples will be collected after the TCs have cooled, which could be the next day before sampling begins again. The DSHW representative will be notified of times when process samples are collected and when leak checks of sampling trains and pitot tubes are conducted. In addition, the DSHW representative will be notified when recovery of samples will begin.

3.2.1 Process Stream Sampling Methods

Liquid process samples will be collected using ASTM Method D3370 (10). The sample will be collected by attaching a sample line to the tap and flushing the sample line. The flush will be managed in accordance with applicable EPA and DSHW regulations. The sample line is inserted into the sample container, and the tap is opened so that the sample fill time exceeds one minute. This sampling flow reduces the loss of volatile compounds from the sampling container prior to closure of the container, and this method ensures that the actual material collected is representative of the stream. Separate sub-sample bottles are used for each sample. Samples of the Brine, NaOH Makeup, and process water will be collected during the ATB using this method.

Mustard agent samples will be collected from each TC as described in Appendix A. A sampling program will be conducted in Area 10 to develop characterization data for the TCs. This data will be used for the trial burn unless the data set is incomplete, which will result in the TC being resampled to obtain a complete data set.

Samples of the solid heel will be collected from each TC used during Condition 2. These samples are limited to Condition 2 because the Condition 1 TCs are anticipated to have minimal solid heels. The sample will be collected and an approximate 2-gram sample will be placed in a screw-top container and transferred to the CAL for metals analyses.

After the TCs have cooled, residues will be removed from the interior of the TC and placed in a dedicated container for each run. A representative sample of the residues in the storage container will be collected with a laboratory scoop or sample thief, using ASTM Method 5633 (11), and placed in amber glass bottles with Teflon®-lined lids.

3.2.2 Mustard in Exhaust Gas Sampling Methods

The MPF TC HD ATB will require special operating conditions for the ACAMS and DAAMS to monitor mustard agent concentrations. (Normal operations of the ACAMS and DAAMS are covered in Section 2.9.2.) The change to the ACAMS operations is that three ACAMS will be sampling the exhaust gas at the MPF Duct. One ACAMS will be in standby, and the other two will be staggered so that one ACAMS is always sampling; the stagger of the ACAMS will be verified hourly. In addition, the ACAMS will be challenged within 30 minutes of the end of the run to ensure that the ACAMS was functional when taken out of service.

There are four changes to the DAAMS operation at the MPF Duct for the ATB, including:

1. One-hour samples will be collected.

2. Two DAAMS stations will be set up on the MPF Duct; one DAAMS station will collect samples while the second station will have a new set of tubes installed and leak checked. When one set is complete, the second station will be started. This mode of operation will allow continuous sampling for *bis*(2-chloroethyl)sulfide.

3. A QP will be included in each set of tubes.

4. A field blank will be analyzed with the DAAMS tube for each run. The field blank will be transported to the sampling location, but not put in service. [Field blanks are a Quality Control (QC) step to ensure data quality.]

3.2.3 Additional Exhaust Gas Sampling Methods

The exhaust gas will be monitored as outlined in Table 3-1 using CEMS and selected EPA sampling trains. The TOCDF CEMS will collect exhaust gas O_2 and CO data. The TOCDF CEMS are discussed in Section 2.9.1. The CO_2, THCs, SO_2, and NO_x concentrations will be monitored using a certified CEMS supplied by the sampling contractor. Certification and calibration data for the sampling contractor's CEMS will be available after the sampling subcontractor has arrived on site and set up the instrumentation. The sampling-contractor-supplied CEMS will also be used to calculate the exhaust gas molecular weight.

The EPA methods for sampling the exhaust gas will be taken from SW-846 (1) and 40 CFR 60 (2), and they include:

- Method 5 (2) and Method 0050 (1) – A combination of these methods sample for PM, HF, Cl_2, and HCl emissions.
- Method 0031 (1) will be used to sample for the VOCs to be collected.
- Method 0010 (1) will be used to sample for the SVOCs to be collected.
- Method 0023A (1) will be used to sample for the PCDDs/PCDFs to be collected.
- Method 0040 (6) will be used to sample for VTOCs to be collected.
- A separate Method 0010 sampling train (6) will be used to sample for the SVTOCs and NVTOCs to be collected.
- Method 29 train (2) will be used to sample for the metals emissions to be sampled.

3.3 ANALYSIS METHODS

Detailed descriptions of the analysis methods are located in Section 9 in the QAPP (see Appendix A). Summaries of the methods used are included in this section for completeness.

3.3.1 Mustard Agent Analysis Methods

Method TE-LOP-584 analyzes a dilution of the agent with a Gas Chromatograph/ Mass Spectrometer (GC/MS). Metals present in the mustard agent are analyzed by digesting the sample and then analyzing the digested sample by TE-LOP-557. Appendix A lists the specific organic compounds and metals to be analyzed as well as the methods of analysis. Samples of the solid heel from TCs used for Condition 2 will be prepared for analyses using TE-LOP-584 and analyzed for metals using TE-LOP-557.

3.3.2 Process Stream Sample Analysis Methods

Samples collected of the process streams will be analyzed by five different methods: VOCs will be determined using Method 8260B (1); SVOCs will be determined using Method 8270C (1); and metals concentrations will be determined using Methods 6010B, 6020, and 7470A (1). These process samples will be analyzed for the metals used in the HHRA.

3.3.3 Residue Sample Analysis Methods

A sample of the TC residues will be collected at the end of each run after the TCs have cooled. The residue samples will be analyzed for mustard agent, total organic compounds, total metals, and evaluated by the Toxicity Characteristic Leaching Procedure (TCLP). Samples of the residues will be digested and then analyzed for the HHRA metals using Methods 6010B, 6020, and 7471A (1). Samples of the residues will be analyzed for total VOCs by Method 8260B and for total SVOCs by Method 8270C, as described in Appendix A. The residues will be extracted by the TCLP Method 1311 (1). The TCLP extract will be analyzed for VOCs by Method 8260B, SVOCs by Method 8270C, and selected metals by Methods 6010B, 6020, and 7470A (1).

3.3.4 Exhaust Gas Sample Analysis Methods

Agent concentrations in the exhaust gas will be measured using the ACAMS and DAAMS as discussed in Section 2.9.2. Samples of the exhaust gas will be collected using seven EPA sampling trains. The analyses methods include the following:

- Method 5 (2) will be used to analyze the PM samples.
- Method 9057 (1) will be used to analyze the halogen emission samples.
- Method 5041A (1)) will be used to analyze the VOCs samples.
- Method 8270C (1)) will be used to analyze the SVOCs samples.
- Method 0023A/8290 (1) will be used to analyze the PCDDs/ PCDFs samples.
- A Gas Chromatograph/Flame Ionization Detector (GC/FID) analysis, as directed by EPA Guidance (6), will be used for VTOC samples.
- A GC/FID analysis, as directed by EPA Guidance (6), will be used for the SVTOC samples.
- Gravimetric analysis, as directed by EPA Guidance (6), will be used for the NVTOC samples.
- Method 6020 (1) will be used to analyze metals emissions samples.
- Method 6C (2) will be used to analyze for SO2.
- Method 7E (2) will be used to analyze for NOx.
- Method 25 (2) will be used to analyze for THC.

3.4 AUDIT SAMPLES

The DSHW could furnish audit samples during the MPF TC HD ATB. In that case, results would be reported in units appropriate to the sample submitted and the analytes present. An audit cylinder containing VOCs for sampling and analysis or a spiked audit sample for analysis could be supplied. The VOC audit cylinder would be sampled at the duct sampling location, and these samples would be packed, transported, and analyzed in the same manner as other samples. The results of the VOC Audit would be reported in parts per billion on a volume basis and included in the final report.

4.0 MUSTARD AGENT TRIAL BURN SCHEDULE

The MPF TC HD ATB is scheduled for the third quarter of 2006. The submittal of this plan will serve as the official 60 day MACT notice required for CPT plans. The DAQ and DSHW will be notified at least 30 days in advance of the actual ATB start date.

4.1 PERFORMANCE RUN SCHEDULE

The trial burn will begin after TOCDF has received approval of the ATB Plan, successfully completed the plant changeover to mustard agent, and successfully completed shakedown of the MPF treating mustard agent. An example of a daily performance run schedule for the MPF TC HD ATB is shown in Figure 4-1. This ATB should span about 8 days: 1 day for setup, 6 days of testing, and 1 day for cleanup. However, the MPF must achieve steady-state conditions by 2:00 p.m. on a test day, or the run will be cancelled for that day. In addition, standby days may be necessary to prepare enough munitions for a complete day of testing.

4.2 DURATION

Two test conditions, each consisting of three replicate sampling runs, are planned. One run will be completed each day for a total of six testing days to complete the ATB. Actual sampling times will be about 5 hr for each run. Steady-state conditions will be established in the MPF before the Test Director authorizes agent feed to start. When the Test Director authorizes feed to begin, the operator will initiate movement of the first loaded tray into the charge airlock. When the outer airlock door is closed, the inner airlock door will be opened and the loaded tray will be moved into Zone 1. The tray will be moved from Zone 1 to Zone 2 at the end of the required time period, and a new loaded tray will be moved to Zone 1. At the end of the second required time period, the first tray will be moved to Zone 3, the second tray moved to Zone 2, and a third loaded tray moved into Zone 1. Exhaust gas sampling will begin when the third tray is placed in Zone 1.

The first tray will be moved from Zone 3 to the discharge airlock after the required time in Zone 3. The tray will remain in the discharge airlock until the airlock timer expires. If no residual agent is detected, the tray will be moved to the discharge cooling conveyor. Each of the trays inside the PCC will be moved to the next zone with a new loaded tray moved into Zone 1. This process will be repeated until all exhaust gas samples are collected. It is expected that feed will be maintained for about 6 hr each day.

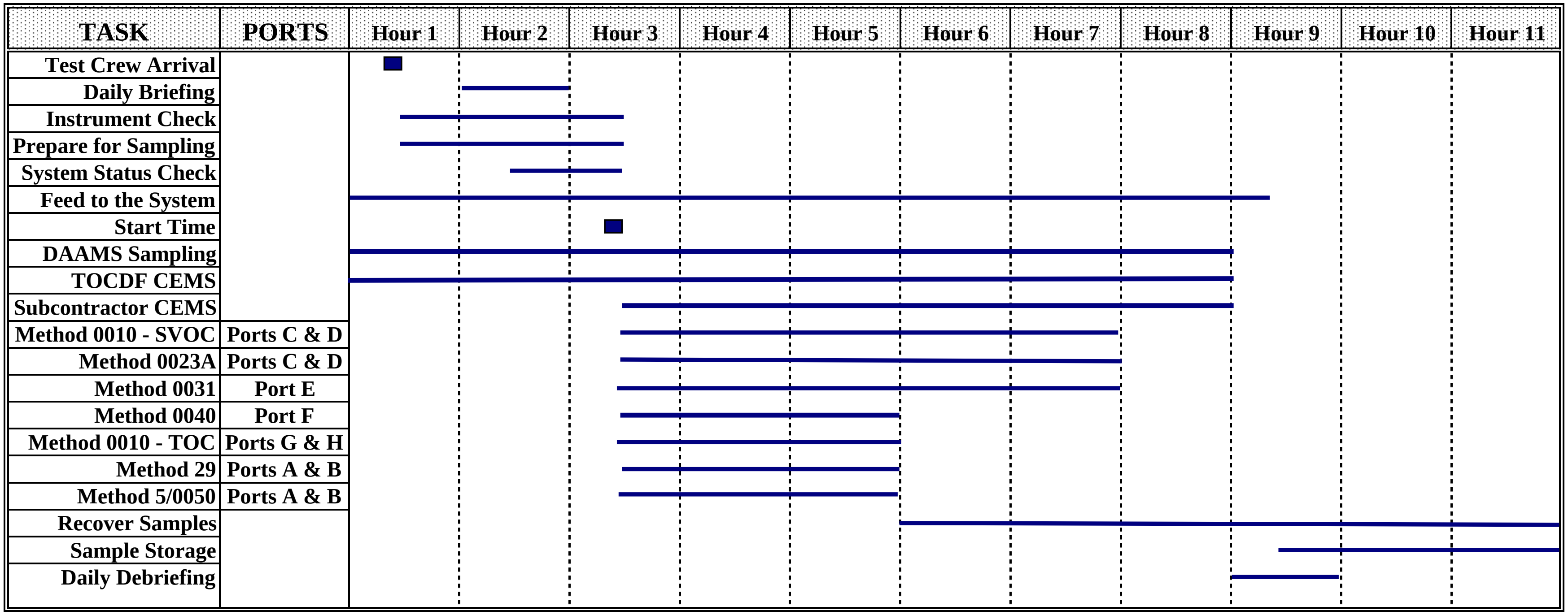


FIGURE 4-1. DAILY SAMPLING SCHEDULE EXAMPLE FOR THE MPF TC HD ATB

5.0 AGENT TRIAL BURN PROTOCOLS

The MPF TC HD ATB will consist of two test conditions with three replicate runs per condition performed at identical operating conditions. The following subsections discuss waste characterization, POHC selection, test operating conditions, and waste feed rates.

5.1 WASTE CHARACTERIZATION

Table 5-1 lists the chemical, physical, and thermodynamic properties of mustard agent, which is the hazardous compound being treated in the MPF. The State of Utah has defined mustard agent as acutely hazardous and identified it as a P999 waste. The same identification is applied to anything contaminated by mustard. TOCDF does not produce or handle any liquids containing PCBs and is, therefore, not subject to TSCA regulations; there is also no treatment of any waste materials with dioxin waste codes (i.e., F020, F021, F022, F023, F026, or F027).

5.1.1 Mustard Waste Feed

The heels remaining in the TCs are a mixture of liquid mustard and solid organic compounds. The liquid waste stream is composed of *bis*(2-chloroethyl)sulfide and the impurities from the starting materials in the manufacture of mustard, stabilizing agents, and the decomposition products of these compounds. The solid compounds are ionic organic compounds that are not soluble in the liquid mustard. The mustard will be fairly consistent in composition, and the expected concentration ranges and major impurities are shown in Table 1-1, which is taken from the DCD mustard characterization summary included in Appendix E. Metals will be spiked onto the trays holding the TCs to account for metals present in the solid heels and from other munitions (see Appendix E and TOCDF RCRA Permit, Attachment 2, Table 2-B-2) to establish a metals feed rate that will allow processing of solid heels and other munitions.

The waste feed characterization for the MPF TC HD ATB is based on two characterization studies conducted by TOCDF on the liquid HD and solid heels present in the HD TCs; the first was the Mustard Characterization Project Report (12) and the second was the Mustard Sampling Validation Project Report (13). The first study used EPA guidance document, RCRA Waste Sampling Draft Technical Guidance, 2002 (14), to establish the number of samples to be 90. Samples from two additional lots were added because they had unusual Lot Identifiers and may be different from the other lots. About half way through the study, six additional samples were selected from lots with high mercury concentrations to determine whether the mercury contamination was lot specific. This increased the total number of ton containers sampled to 98. The six additional samples did not establish that the mercury contamination was lot specific. In addition, eight field duplicate samples were collected.

TABLE 5-1. MUSTARD AGENT PROPERTIES

PROPERTY	HD	HT
Chemical Name	*bis*(2-chloroethyl) sulfide	60:40 H:T T = *bis*[2-(2-chloroethylthio)ethyl] ether
Chemical Formula	H = $C_4H_8Cl_2S$	T = $C_8H_{16}Cl_2OS_2$
Molecular Weight (g/mole)	159.08	T = 263.25; 60:40 = 200.75
Chlorine (Wt%)	44.57 %	T = 26.93 %; 60:40 = 37.51 %
Vapor Specific Gravity	5.4	6.92
Liquid Density @ 77 °F (lb/ft^3)	79.29	79.29
Freezing Point (°F)	57	34
Boiling Point (°F)	442	442
Flash Point (°F)	221	212
Vapor Pressure @ 68 °F (mmHg)	0.072	0.104
Viscosity @ 77 °F (centistokes)	3.95	6.05
Color	Amber to Dark Brown	Amber to Dark Brown
Odor	Garlic	Garlic
Solubility	Completely soluble in acetone, CCl_4, tetrachloroethane, ethyl benzoate, and all ethers	Completely soluble in acetone, CCl_4, tetrachloroethane, ethyl benzoate, and all ethers
Higher Heating Value (Btu/lb)	8,500	9,400
Physical State	Viscous Liquid	Viscous Liquid

The sample results for the original 92 samples showed 78 TCs with liquid mustard mercury concentrations of < 1 mg/kg, which was 84.78 % of the total. This means that about 5,400 TCs meet this criterion for processing during the Mustard Baseline Operations. The remaining TCs will be processed using additional pollution control measures to control the mercury emissions.

The total of 98 TCs had 80 TCs that met the liquid Mustard Baseline Operations criterion concentration of < 1.0 mg/kg. The mercury results for liquid mustard and solid heels were evaluated to establish some characteristics of the Baseline TCs. The field duplicate results were averaged, and this average was used in the data evaluation. An average of these 80 data points was calculated using the reported values between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) without any adjustment, and those with no mercury detected used the PQL to calculate the average. The data average was 1.33 mg/kg with a standard deviation of 3.35. The maximum value was 24.45 mg/kg, which was the average of a field duplicate. In an effort to estimate the maximum mercury concentration in the Baseline TC solid heels, a confidence interval was calculated from the standard deviation times the κ factors from Table G-2 Factors for Parametric Upper Confidence Bounds on Upper Percentiles in the Draft Waste Sampling (14). This gave a maximum anticipated concentration of 33 mg/kg (24.45 mg/kg +2.638*(3.35) = 33 mg/kg).

The variability of the HD mercury data raised additional concerns. The field duplicate data for the 80 Baseline TCs had the Relative Percent Difference (RPD) calculated. Percentage-wise, there appears to be a large variation in some of the results, but where the results were above the PQL, the agreement was very good with an RPD of < 10 %. The variability of the data was also addressed by a data evaluation from the Mustard Sampling Validation Project Report (13). Four of the 13 TCs sampled in this report meet the criteria for Baseline Operations. Table 5-2 shows a comparison of the original data from the Mustard Characterization Study to the three samples of the solids collected in the Validation Study. The three samples from each TC had some variability, but they were in line with each other and the original data generated. The conclusion of the variability evaluation is that there is little variability in the samples from Baseline TCs. No samples from the Validation Study exceeded the range of values developed during the Mustard Characterization Study for Baseline TCs.

Table 5-3 shows the distribution of the 80 mercury results for solid heels. The distribution of these data appears to be exponential with the bulk of the results below the PQL. The results distribution was used to estimate the amount of mercury in the Baseline TCs, and these estimates are shown in Table 5-3. Heel depths of 2 inches, 4 inches, and 6 inches were used to calculate that the total mass of mercury in the Mustard Baseline Operations TCs is between 0.7 lb and 3.8 lb. Assuming that the average heel depth is 4 inches, this gives an estimated amount of 2.5 lb. Using this estimate, an average concentration over the 18-month period to process 5,400 TCs was calculated to be 13.4 µg/dscm (the MACT Standard is 130 µg/dscm) with an emission rate of 7.22E-5 grams/sec (g/sec) (4.45E-4 g/sec DCD HHRA mercury limit).

TABLE 5-2. COMPARISON OF ORIGINAL DATA TO VALIDATION STUDY BASELINE TC SOLID SAMPLES

	D46673	D14856	D17911	D79558
Original Value	0.327	0.299	1.76	14.5
VS-1	0.257	0.757	2.53	13.4
VS-2	0.324	0.531	10.4	13.2
VS-3	0.152	0.94	2.1	12.3
VS Average	0.244	0.743	5.01	12.97
Standard Dev.	0.087	0.205	4.67	0.59
RSD	35.5	27.6	93.3	4.5
Overall Average	0.265	0.63175	4.1975	13.35
Std. Dev.	0.082	0.278	4.147	0.904
RSD	30.9	44.0	98.8	6.8

TABLE 5-3. ESTIMATION OF MERCURY CONTENT OF BASELINE TON CONTAINERS

				Heel Depth (inches) :		2	4	6
				Solid Heel Wt. (lb):		100	335	514
				Liquid Heel Wt. (lb):		96	104	118
Range	**No.**	**% Total**	**70**	**5400**	**Conc. Used (mg/kg)**	**Mercury (lb)**	**Mercury (lb)**	**Mercury (lb)**
< PQL	50	62.5	44	3375	0.25	0.084	0.283	0.434
PQL to 1 ppm	10	12.5	9	675	0.75	0.051	0.170	0.260
1 ppm to 2 ppm	10	12.5	9	675	1.5	0.101	0.339	0.520
2 ppm to 3.75 ppm	6	7.5	4	405	3.0	0.122	0.407	0.625
3.76 ppm to 7 ppm	1	1.3	1	68	5.5	0.037	0.124	0.191
7 ppm to 12 ppm	1	1.3	1	68	8.5	0.057	0.192	0.295
12 ppm to 19 ppm	1	1.3	1	68	15.5	0.105	0.351	0.538
19 ppm to 33 ppm	1	1.3	1	68	26.0	0.176	0.588	0.902
Total	80		70	5400		0.733	2.454	3.765

The conclusion of this evaluation is that the anticipated mercury emissions are less than 2.5 lb spread over an 18 month period resulting in emission concentrations and emission rates that are about 10 % of the regulatory limits.

A critical mercury concentration in the solid heels was calculated where additional amounts of that element would cause the emission limits to be exceeded. The mercury critical concentration for a 632 lb heel was 3.84 mg/kg. Table 5-3 shows the percentage of the Baseline TCs below the critical concentration is 95%. This means that, even with a heel weight of 632 lb, the mercury emission rate will not exceed the emission limits 95% of the time. Since the mercury emissions will be averaged over a sampling period of 4 hours, there is a low probability that the 12-hour rolling average will ever exceed the MACT limit of 130 µg/dscm or the emission rate used in the HHRA of 4.45E-4 g/sec.

A representative sample of the liquid agent in each TC used during the ATB will be collected. The samples will be analyzed for organic compounds and metals concentrations. The liquid mustard processed in the MPF TC HD ATB will be about 89 Wt% *bis*(2-chloroethyl) sulfide; 3.2 Wt% 1,2-*bis*(2-chloroethylthio)ethane (Q); 1.4 Wt% 1,4-dithiane; 0.6 Wt% 1,2-dichloroethane; and 0.2 Wt% T. Metals contamination will be limited to arsenic, chromium, copper, manganese, nickel, and zinc at < 100 ppm. The DRE calculations will be based on the purity analysis of the agent processed during the ATB.

The solids in the TCs are S-(2-chloroethyl)-1,4-dithianium chloride with varying metals concentrations. Samples of the solid heel will be collected from each TC used for Condition 2, unless the TC was sampled for the Mustard Characterization Study and the analyses are already available. Table 1-2 summarizes the metals present, their average concentration, standard deviation, and their concentration ranges.

5.1.2 Metals Spiking Materials

Metals processed in the MPF can be associated with the agent remaining in the TC, metals in the solid heels, or metals on the outside of the TC which are associated with the paint on the TC. The MPF TC HD ATB is anticipated to have low metals concentrations in the Condition 1 wastes processed and variable metals concentrations in the solids processed during Condition 2. Therefore, it was decided to spike metals when processing the TCs in Condition 1 to demonstrate metals feed rates to encompass the potential metals feed rate from Condition 2 solid materials and the paint from the exterior of TCs and mortars. Table 5-4 shows the possible metals sources for the MPF TC HD ATB. The first column lists the metals from paint on the exterior of the TCs and the second column lists the metals from paint on the exterior of two trays of mortars. The third column lists the maximum value from the 80 Baseline tons sampled in the Mustard Characterization Study (12). The fourth column shows the Project Maximum Concentration that was calculated from the maximum value plus a κ factor from Table G-2 times the standard deviation. The κ factor was based on 95 % confidence that the value is in the 99 percentile of concentrations in the 5,400 Baseline TCs.

TABLE 5-4. DEVELOPMENT OF SPIKING AMOUNTS FOR MUSTARD TON CONTAINERS

Element	TC Non-emb. Metals (lb/charge) [a]	Mortars Non-emb. Metals (lb/charge) [a,b]	Solids Maximum Conc. (mg/kg)	Project [c] Maximum Conc. (mg/kg)	TC Maximum 632 (lb/heel)	TC Total Metal (lb/charge)	Module V Table V.2 Total (lb)	Metal Spiked (lb/charge)	Module V Table V.2 Spiked Total (lb)	Current Module V Table V.2 Total (lb)
Aluminum			160	220	0.139	0.139				
Antimony			30.3	40.1	0.025	0.025				
Arsenic			1850	2876	1.818	1.818	12.6 [d]	2.0	13.8 [d]	
Barium	0.64	3.50	14.2	20.2	0.013	3.513	48.6 [e]			240 [e]
Beryllium			< 5.6 U	7.9	0.005	0.005	0.035 [d]			
Boron			< 11 U	15.6	0.010	0.010				
Cadmium	0.330	1.8	< 5.3 U	9.7	0.006	1.806	12.5 [d]	2.0	13.8 [d]	
Chromium	0.18	1.00	397	552	0.349	1.349	9.3 [d]	2.0	13.8 [d]	
Cobalt			27.1	41.2	0.026	0.026				
Copper			2350	3121	1.972	1.972				
Lead	2.8	6.3	625	891	0.563	6.883	47.7 [d]	4.5	31.2 [d]	
Manganese			1960	2657	1.679	1.679				
Nickel	0.33	1.8	965	1360	0.860	2.660				
Selenium			< 28 U	40.9	0.026	0.026	0.36 [e]			0.036 [e]
Silver			< 5.6 U	10.1	0.006	0.006	0.088 [e]			10 [e]
Thallium			< 5.6 U	6.5	0.004	0.004				
Tin			52.6	82.7	0.052	0.052				
Vanadium			< 5.6 U	10.4	0.007	0.007				
Zinc			4950	6603	4.173	4.173				
					SVOL Total	8.689	60.2	6.5	45.0	61.08
					LVOL Total	3.171	22.0	4.0	27.7	7.62

Notes:

This data includes TCs with liquid mustard mercury concentrations < 1 mg/kg.

U indicates that none of the values exceeded the PQL.

[a] Data taken from TOCDF RCRA Permit Attachment 2, Table 2-B-2.

[b] This rate is based on 2 trays of mortars being feed in the time for 1 TC.

[c] Maximum Values was calculated for 95 % confidence that the value is in the 99 Percentile.

[d] Total is based on 12-hour rolling average.

[e] Total is based on 24-hour Total.

The fifth column used the Project Maximum Concentration to calculate the total mass of that element based on a 632 lb heel. The TC Total Metals column is the sum of the metals from the solid heel and the metals from the mortars since the metals from the mortars are higher than the metals from the TCs. This total column indicates the maximum possible metals anticipated for the Baseline Mustard Operations and mortars processing. These values were used to calculate a total on the same basis as Table V.2 in the TOCDF RCRA Permit, Module V. These totals were compared to the values in Table V.2, which are shown in the last column of Table 5-4.

The values for arsenic cadmium, chromium, and lead indicated the need to request increased metals feed limits and demonstrate the new limits by spiking. The spiking levels were then selected and new totals calculated on the Table V.2 basis and the proposed increased metals feed limits.

Metals spiking materials for mustard processing will be prepared from solid metal compounds. The metals spiking amounts were determined as discussed above. The spiking metals feed rates proposed for the MPF TC HD ATB are shown in Table 5-5. These compounds listed in the table are suggested; the actual compounds used may be different, but the elemental spiking rate will be maintained. If changes to the actual spiking compounds are necessary, the DAQ and DSHW will be notified before the change is final. The metals spiking amounts are not anticipated to have a negative impact on the environment. The PAS will remove metals emissions (except mercury) from the exhaust gas.

The compounds selected for spiking were chosen based on their chemical properties. The arsenic oxide (As_2O_3) melts at 595 ºF (313 ºC), boils at 869 ºF (465 ºC), and sublimes between these temperatures. Based on this data, it is anticipated that the arsenic will be in the vapor phase in the MPF. Cadmium Oxide (CdO) was demonstrated to be volatile during the MPF GB ATB when CdO was spiked and detected in the Brine. This indicates that the cadmium will leave the MPF in the vapor phase. Chromium acetate hydroxide was chosen because it is a metal salt of an organic acid and should burn during treatment, which will introduce the chromium into the exhaust gas. Lead oxide (PbO) is anticipated to react with the HCl generated by burning the mustard to produce lead chloride ($PbCl_2$) and PbO in the vapor phase.

5.2 POHC SELECTION RATIONALE

Mustard agent was selected as the POHC for the MPF TC HD ATB. The analytical procedures are well established for mustard which will establish the mass entering the system and the mass leaving the system. Table 1-1 shows that the mustard agent concentration averages are over 87 Wt% and the other organic compounds are present at < 3 Wt%. Mustard is representative of the other compounds present on the basis of thermal stability and the difficulty of incinerability, and it is the most toxic of the compounds present in the feed to the MPF. Therefore, on the basis of concentration, toxicity, and incinerability, *bis*(2-chloroethyl) sulfide is the best choice for the POHC.

TABLE 5-5. MPF METALS SPIKING FEED RATES AND ESTIMATED METALS EMISSION RATES

MPF Exhaust Gas Flow Rate:	3,829 dscfm	**Charge Time:**	104 min
MPF Exhaust Gas O_2 Conc.:	10.4 %	**Sample Volume:**	71.539 dscf

Element	Lab PQL (µg)	PQL Feed Rate (lb/hr)	Spiking Feed Rate (lb/charge)	Spiking Compound [a]	Compound Feed Rate (lb/charge)	Metals Removal Efficiency	Calculated Emission Rate (g/sec)	Calculated Conc. @7% O_2 (µg/dscm)	HHRA Emission Rate (g/sec)	MACT Conc. Limit @7% O_2 (µg/dscm)
Arsenic	0.3	0.0212	2.0 [b]	As_2O_3	2.64	99.985 [c]	2.18E-05	15.9	2.79E-06	
Cadmium	0.15	0.0106	2.0 [b]	CdO	2.28	99.948 [c]	7.56E-05	55.3	6.48E-05	
Chromium	0.3	0.0212	2.0 [b]	Chromium Acetate Hydroxide	8.00	99.9981 [c]	2.76E-06	2.02	2.20E-06	
Lead	0.15	0.0106	4.5 [b]	PbO	4.85	99.988 [c]	3.93E-05	28.7	1.35E-05	
				Total Spiking Compounds	17.77					
				Total Estimated Ash	12.70					
							Semi-Volatile Metals	83.9		230
							Low-Volatility Metals	18.0		92

Notes:

The MACT Limit for Semi-Volatile Metals is the summation of Pb + Cd = 230 µg/dscm.

The MACT Limit for Low Volatility Metals is the summation of As + Be + Cr = 92 µg/dscm.

Beryllium was not spiked due to its toxicity and it has not been identified in TOCDF wastes.

[a] The spiking compounds are suggested and may be substituted with another compound for testing.

[b] The spiking rate is based on data shown in Table 5-2.

[c] MRE is based on the value from the MPF SWDT.

5.3 TEST PROTOCOL AND OPERATING CONDITIONS

This ATB will demonstrate that system operations comply with State and Federal environmental regulations by ensuring the collection of the samples and operating data needed for the RCRA Permit, the data necessary to update the DCD HHRA, and the data to support Title V permit requirements. The main goal of the MPF TC HD ATB is to demonstrate operation of the MPF while processing TCs, which contain solids covered by liquid mustard. This demonstration will consist of two parts: the demonstration of the mustard DRE and the demonstration of processing TCs with high solid heels. The MPF TC HD ATB will be conducted as two test conditions, and each test will have three performance runs to meet the trial burn objectives. One condition will use liquid mustard heels in TCs to demonstrate a maximum agent feed rate at minimum temperatures in the MPF PCC and AFB. The second condition will use TCs with solid heels mixed with liquid mustard to demonstrate the processing of the solid residues in the TCs. Metals spiking will be used to cover the range of possible metals to be fed to the MPF over the course of the Mustard Agent Campaign.

5.3.1 Development of Worst-Case Criteria

This ATB is based on modeled calculations of the feed intervals and feed weights to be fed to the MPF while processing TCs containing liquid mustard and solids from the decomposition of liquid mustard. These calculations are summarized in reports in Appendix C along with the MEBs that were based on the modeled calculations. The basis for this ATB is the ability to process TCs with up to 6 inches of solid residues in the bottom of the TCs with 2 inches of liquid mustard remaining on top of those residues. The MEBs were calculated based on 514 lb of solids and 118 lb of liquid mustard, for a total of 632 lb of material remaining in the TCs, as shown in Appendix C. The total weight will be controlled at approximately 632 lb, but the weight of the heel cannot be controlled and an average solid heel will be estimated from the data available. The shakedown period will use an incremental approach to reach the maximum feed limits for the MPF. The limits on the operation are that the feed intervals will not be less than 42 min and the total mass per charge will not exceed 632 lb. The optimum feed interval and total mass fed will be established during the shakedown period.

The worst case for metal feed rates will be established using spiking materials due to the limited information available on the metals content of the solid heels before the actual ATB begins. Section 5.3.5 discusses the metal spiking to take place.

5.3.2 Test Condition 1

Condition 1 will demonstrate a maximum mustard feed rate, minimum mustard DRE, and a maximum metals feed rate (by adding metals spiking materials to the TC trays). Condition 1 will use TCs with minimal solid heels and up to 632 lb of mustard as the heel, which corresponds to approximately 10 inches of liquid mustard in the TCs. The TCs will be fed at intervals established by the shakedown, but will be no less than 42 min. This condition will represent the worst case for calculation of the DRE. The shape and distribution of the solids will make it possible to determine the total mass, but difficult to ascertain how much to attribute liquid mustard and how much to solids. To minimize this concern, this condition will use all liquid mustard to allow an accurate measurement of the liquid mustard by minimizing the solids present. This will demonstrate an increased agent heel for mustard agent over the 5 % agent heels processed during the Agent GB and VX Campaigns. This feed rate of agent will be processed at the minimum temperatures in the PCC and the AFB. The MEBs in Appendix C illustrate the estimated flows and temperatures for this test condition.

5.3.3 Test Condition 2

Condition 2 will demonstrate processing the maximum solid heel weight and that the emissions from processing solid heels are not significantly different from emissions from processing liquid mustard. Condition 2 will demonstrate the maximum solid heel with about two inches of liquid mustard over the solids for a combined solid heel and liquid heel weight of 632 lb. The TCs will be moved to the drain station, weighed, punched, drained, and reweighed. The weight removed is determined from the initial weight at the drain station minus the drained weight at the drain station. The weight removed will be subtracted from the fill weight to determine the weight remaining in the TC. The TC fill weights and tare weights are available in a data base that will be used for determining the weight of the heel in each TC processed.

Condition 2 will be monitored for agent, but a DRE will not be calculated. An example DRE for Condition 2 was calculated in Section 11 of Appendix A using 118 lb of mustard and it shows that a DRE greater than 99.99 % will be possible when no mustard is detected in the DAAMS tubes. Mustard in the exhaust gas will be monitored and reported, but a DRE will not be calculated since the exact amount of liquid mustard will not be determined. The total weight of the liquid heel and the solid heel will be determined based on the weight remaining in the TC. The solid heel level will be determined in Area 10 during the sampling operation and no further attempts will be made to determine the amount of solids in the TCs.

5.3.4 Proposed Test Operating Conditions

The TOCDF MPF is operated as a batch feed incinerator. Feed rates will be maximized during the shakedown period and MPF TC HD ATB, but operating conditions will remain within the limits in Appendix D. Combustion airflows in the system vary over a small range, and the system pressures are maintained negative relative to the MPF furnace room. Operation of the PAS follows that of the furnace; hence, fluctuations in the PAS operating conditions are limited. Brine pH is controlled at a pH of ≥ 7.0 to remove the acid gases from the exhaust gases. Brine flows are controlled principally to maintain PAS component liquid levels and temperatures.

The operating conditions will be held constant for both test conditions. The waste feed rate for Conditions 1 and 2 will be 632 lb per charge fed at a minimum interval of 42 min. Temperatures in the PCC will be held between 1,200 °F and 1,800 °F with the HRA ≥ 1300 ºF. The AFB exhaust gas temperature will be held between 1,900 °F and 2,175 °F. The residence time in the AFB will be > 0.5 seconds. The O_2 concentration will be maintained between 3 % and 15 %, and the CO concentration will be below 100 ppm @ 7 % O_2.

Operating conditions for this test include:

- Normal tray feed rates to the PCC. (These are also the maximum permitted rates for the TCs.)

- Maximum allowable agent heel in each TC (632 lb).

- Minimum temperatures in the PCC and AFB.

- Normal quench tower and venturi scrubber Brine flows, minimum venturi scrubber pressure drop, and minimum Brine pH and maximum Brine density.

- Normal clean liquor flow rate, with a minimum pH, and maximum density.

- Additional ACAMS and DAAMS to monitor exhaust gases in the MPF Duct.

5.3.5 Metals Spiking Operations

A subcontractor specializing in spiking operations for trial burns will prepare the spiking materials and ship them to TOCDF. Mercury will not be spiked with the other metals because of the potential for low levels of mercury being present in the solids. The metals spiking materials will be solid, metal compounds weighed into containers that will allow placement of the spiking materials on the trays with the TCs prior to being fed to the MPF. Operations will be responsible for the preparation of the trays including placement of the spiking materials. The amount of spiking materials in each packet and the feed interval will set the metals spiking feed rate. These data, combined with the certified concentrations provided by the metals spiking subcontractor, will be used to determine the metals feed rate for the spiking materials.

Table 5-5 shows the estimated Metals Removal Efficiency (MRE) based on data from previous tests conducted at TOCDF. An estimated emission rate and estimated concentration for each metal are calculated to compare to the HHRA emission rates and the MACT emission concentrations. The calculated emission rates are higher than the September 2003 DCD HHRA rates and will require a recalculation of the risk. Estimated emission rates for the ATB are shown in Table 5-5 and these emission rates are just slightly higher than the HHRA emission rates indicating a minimal additional risk for conducting the test. They are not anticipated to have a negative impact on human health or the environment because the calculated concentrations are less than the proposed HWC MACT concentration limits.

Metals will be spiked at a high enough rate to ensure reliable data. Table 5-5 shows the Practical Quantitation Limit (PQL) for the elements and the calculated feed rates based on the PQL. The spiking rates were more than 10 times the PQL-based feed rate to ensure reliable data. These demonstrated spiking levels will be used to calculate an extrapolated maximum feed rate if the measured emission concentrations are not within 75 percent of the MACT regulatory limits. The measured emissions will be used to calculate a ratio of the regulatory emissions to the measured emissions. The demonstrated feed rates will then be multiplied by the ratio and by 75 percent to determine a maximum feed rate as allowed by the EPA Guidance (5). An example of the calculation follows:

$$\text{Ratio} = (\text{MACT Limit in } \mu\text{g/dscm}) / (\text{Cd} + \text{Pb in } \mu\text{g/dscm})$$
$$= (230\ \mu\text{g/dscm}) / (46.2 + 49.9)\ \mu\text{g/dscm} = 2.3933$$

$$\text{Extrapolated Feed Rate} = (\text{Cd Feed} + \text{Pb Feed}) * (\text{Ratio}) * 0.75$$
$$= (5.0\ \text{lb/hr} + 18.0\ \text{lb/hr}) * (2.3933) * 0.75 = 41.28\ \text{lb/hr}$$

The metals spiking packages will be assembled by an outside subcontractor and placed on the trays by TOCDF personnel. The compounds will be weighed into plastic bags, and the plastic bags will be placed on the cradle with the TC. The spiking packages will contain 14.0 lb of spiking compounds (as shown in Table 5-5), and about 0.5 lb of plastic bags to contain the spiking compounds. Exact weights will be recorded for the ATB to document the feed rates. This composition will result in a 14.5-lb package with 10.2 lb of ash and an HHV of 11,700 Btu/charge.

5.4 COMBUSTION TEMPERATURE RANGES

The anticipated PCC temperatures for all three zones are between 1,200 °F and 1,800 °F with the HRA ≥1300 ºF. The anticipated AFB temperatures will be between 1,900 °F and 2,175 °F. Experience with the MPF would indicate that the temperatures vary within this temperature range. Initial heating of the loaded tray followed by rapid combustion can cause excursions of -150 °F and + 50 °F in the MPF PCC. If such temperature fluctuations occur in the PCC, the AFB would be likely to experience a smaller, but corresponding, temperature variation. These temperatures are consistent with the AWFCO tables located in Appendix D.

5.5 WASTE FEED RATES AND QUANTITIES OF WASTES TO BE BURNED

Trays bearing one TC containing a 632 lb heel and 74 lb of metals spiking materials during Condition 1 will be fed to the MPF at a frequency that is no less than every 42 min. The anticipated mustard agent usage rates for the MPF TC HD ATB are summarized in Table 5-6. The feed interval of 40 minutes was used for the purpose of preparing these estimates. The mustard agent required for Condition 1 is estimated at 6,952 lb/run for a total of 20,856 lb. Allowing a 25 % safety factor, the consumption of mustard agent is expected to be about 26,070 lb of mustard agent and 41 TCs. Condition 2 will use a total of 11 TCs per run for a total of 33 TCs and about 20,856 lb of heel, which is a combination of liquid mustard agent and solid residues. Allowing a 25 % safety factor, the consumption of liquid and solid heels for Condition 2 are estimated at 26,070 lb of heel and 41 TCs.

Mustard agent usage rates are not shown for the Condition 2 runs because the heel amount will be a combination of solid residues and liquid mustard and a DRE will not be calculated. Condition 2 will demonstrate the maximum solid heel feed rate to the MPF. Agent will be monitored in the exhaust gas for Condition 2 in the same manner as in Condition 1. The DAAMS tubes will be collected and analyzed, but no agent feed rates will be calculated for Condition 2.

TABLE 5-6. MUSTARD AGENT REQUIREMENTS FOR THE MPF TC HD ATB

Activity	Condition 1		Condition 2	
	Mustard (lb)	Number of TCs Required	Total Heel (lb)	Number of TCs Required
Loading the MPF	1,896	3	1,896	3
Exhaust Gas Sampling (5 hr)	5,056	8	5,056	8
Total per Performance Run	6,952	11	6,952	11
Total per Test Condition	20,856	33	20,856	33

5.6 EXHAUST GAS VELOCITY INDICATOR

Exhaust gas flow rates for the MPF are measured with a V-Cone® installed in the exhaust duct, which is located after the scrubber tower and before the demister, to measure the volumetric flow rate. The V-Cone® is positioned in the center of the duct to increase the velocity of the exhaust flow, which creates a differential pressure. The pressure difference is measured and converted to a gas flow rate. The MPF control system records the value and generates an HRA. If the HRA setpoint is exceeded, the PLC causes a stop feed and an alarm.

5.7 AUXILIARY FUEL

Natural gas will be used as required to maintain temperatures at the prescribed thermal duty in both the PCC and the AFB. In addition, natural gas is used as the PCC and the AFB pilot burner fuel. The typical composition of the natural gas supplied to TOCDF is shown in Table 5-7.

TABLE 5-7. AVERAGE NATURAL GAS COMPOSITION

PARAMETER	AVERAGE VALUE *
Higher Heating Value (Btu/ft^3)	1043
Gas Density (lb/ft^3)	0.5857
Nitrogen (mole %)	0.41
Carbon Dioxide (mole %)	0.52
C1 (mole %)	95.60
C2 (mole %)	2.5
C3 (mole %)	0.631
C4 (mole %)	0.117
iso-C4 (mole %)	0.116
n-C5 (mole %)	0.028
iso-C5 (mole %)	0.039
C6 (mole %)	0.021
C7 (mole %)	0.012
C8 (mole %)	0.005
C9 (mole %)	0.0006

* Monthly average from June 2005.

5.8 WASTE FEED ASH CONTENT

Ash generated from the combustion of mustard agent will come from the metals in the liquid agent, the ash in the solid heels, and the metal spiking materials added during Condition 1. Some residues will be present in the TCs and projectiles, and it will contribute to particulate emissions. Table 5-8 shows the ash generation rate of 15.0 lb/charge for Condition 1 and 121.3 lb/charge for Condition 2. The maximum ash generation rate from Condition 2 comes from the solid heel in the TC. Ash particles exiting the AFB will be trapped in the PAS or measured in the MPF Duct. No spiking of the waste feeds will be conducted to generate ash or PM.

TABLE 5-8. MPF MUSTARD ATB ASH GENERATION RATES

	Condition 1	**Condition 2**
Waste Feed	Liquid Mustard	Mixed Liquids/Solids
Ash from Spiking Materials (lb/charge)	10.2	0
Heel/Charge (lb)	632	632 (solids + liquid)
Ash Generated From Heel (lb/charge)[a]	< 1.0	116.5
Ash From Paint Pigments (lb/charge)[b]	4.8	4.8
Ash Generation Rate (lb/hr)	**15.0**	**121.3**

[a]Ash generated from metals in agent is not considered.
[b]Data on metals in paint taken from Tables 2-B-1 and 2-B-2 of TOCDF RCRA Permit, Attachment 2..

5.9 ORGANIC CHLORINE CONTENT OF THE WASTE FEED

Mustard agent contains organic chlorine in the agent molecule and the impurities that are listed in Table 1-1. The average composition listed in Table 1-1 corresponds to an average organic chlorine concentration of 41.5 Wt% or a feed rate of 262 lb/charge for Condition 1. Condition 2 would have an organic chlorine feed rate of 159 lb/charge for solids, based on the data in Appendix E, and 49 lb/charge for liquid mustard for a total of 208 lb/charge. Any chlorine measured in the MPF duct will be attributed to the combustion of the organic chlorine present in the feed. Concentrations of HCl and Cl_2 in MPF emissions will be determined using Method 0050 (1), and details are in the Appendix A. QAPP.

5.10 METALS FEED RATES

There are only trace amounts of metals in mustard agent, as shown in Table 1-1. Concentrations of metals in the solid residues in the TCs are shown in Table 1-2. The maximum metals concentrations from Table 1-2 were used to calculate an estimated worst case of metals feeds to the MPF and are shown in Table 5-9. The total metals possible were compared to the spiking metals feed rate and were found to be less than the metals spiked during Condition 1. The calculated emission rates in Table 5-9 were compared to the emission rates used in the HHRA and were similar. The metals load to the MPF will come from spiking materials fed in Condition 1. Actual metals emissions will be sampled using Method 29 (2). The sampling and analysis details for metals emissions are in Appendix A.

5.11 POLLUTION CONTROL EQUIPMENT OPERATIONS

Operation of the pollution control equipment is provided in this section as required by 40 CFR 270.62(b)(2)(vi). Standard operating conditions for the pollution control equipment are described in Section 2.10. Fluctuations in PAS temperatures, flow rates, pressures, pH, and density will occur during the trial burn. These normal variations will be reported in the final ATB Report. The anticipated operating conditions for the MPF TC HD ATB are the same as standard operating conditions, and their limits are summarized in Appendix D.

5.12 SHUTDOWN PROCEDURES

Shutdown Procedures to be observed during the MPF TC HD ATB are discussed in this section as required by 40 CFR 270.62(b)(2)(vii). (The AWFCO system and parameters for shutting down the waste feeds are described in Section 2.8.) The AWFCOs for Group A are continuously monitored and interlocked, and Group C parameters, which are also monitored and interlocked, will be in operation during the MPF TC HD ATB. (Group B parameters will not be monitored continuously.) During the ATB, the system's operation will be monitored closely by the system operators. If the operation of the system should deviate significantly from the desired range of operation or become unsafe, the operators would manually shut off waste feeds to the system.

Sampling will be stopped if an AWFCO prevents the feeding of the next tray on schedule. The AWFCOs do not stop the waste combustion in the MPF, but they can prevent feeding additional waste to the furnace. If the condition(s) causing an AWFCO cannot be corrected before the next tray is scheduled to be fed to the MPF, sampling will be stopped until the MPF can be reloaded with waste. Should the AWFCO condition persist for 2 hr, the run would be aborted. A run will also be aborted if more than three AWFCOs occur during one traverse of the 4-hr sampling trains. If the DAQ and/or the DSHW representatives approve continuing a run after either of the abort conditions is reached, the approval will be documented and included in the deviation discussions in the final report.

TABLE 5-9. ESTIMATED TOTAL METALS FEED RATES AND METALS EMISSIONS RATES

MPF Exhaust Gas Flow Rate:		3,829 dscfm					**Charge Time:**		104	min
Solid Residue Feed Rate:		632.0 lb/charge					**MPF Exhaust Gas O_2 Concentration:**		10.4	%
Element (Metals Group Number)	**Project Maximum Residue Conc. (Wt.%)**	**Metal Feed Rate from Heel (lb/charge)**	**Metal Spiked (lb/charge)**	**TC Non-Embedded Metals (lb/charge)**	**Total Metal Feed Rate (lb/charge)**	**Metals Removal Efficiency**	**Calculated Emission Rate (g/sec)**	**Calculated Conc. @7% O_2 (μg/dscm)**	**HHRA Emission Rate (g/sec)**	**MACT Conc. Limit @7% O_2 (μg/dscm)**
Aluminum	0.022	0.139			0.139	99.985 [a]	1.52E-06	1.11	5.18E-04	
Antimony	0.00401	0.025			0.025	99.9963 [b]	6.82E-08	0.050	7.75E-07	
Arsenic	0.2876	1.818	2.00		3.818	99.985 [a]	4.16E-05	30.4	2.79E-06	92
Barium	0.00202	0.013		0.64	0.653	99.9923 [a]	3.65E-06	2.67	4.03E-05	
Cadmium	< 0.01	NC	2.00	0.33	2.330	99.948 [a]	8.81E-05	64.4	6.48E-05	230
Chromium	0.0552	0.349	2.00	0.18	2.529	99.9981 [a]	3.49E-06	2.55	2.20E-06	92
Cobalt	0.00412	0.026			0.026	99.9894 [c]	2.01E-07	0.147	1.66E-05	
Copper	0.3121	1.972			1.972	99.9921 [c]	1.13E-05	8.28	8.72E-06	
Lead	0.0891	0.563	4.50	2.80	7.863	99.988 [a]	6.86E-05	50.1	1.35E-05	230
Manganese	0.2657	1.679			1.679	99.9477 [c]	6.38E-05	46.7	2.66E-04	
Mercury [d]	0.000159	0.001			0.001	10	6.57E-05	48.0	4.45E-04	130
Nickel	0.136	0.860		1.8	2.660	99.997 [c]	5.80E-06	4.24	1.78E-05	
Tin	0.00827	0.052			0.052	99.9939 [b]	2.32E-07	0.17	1.54E-04	
Zinc	0.6603	4.173			4.173	99.965 [a]	1.06E-04	77.6	2.08E-04	
Semivolatile Metals Total					10.19			114.48		230
Low Volatility Metals Total					6.35			32.97		92

Notes:

[a] MRE is based on the value from the SWDT.

[b] MRE is based on the arsenic value from the SWDT.

[c] MRE is based on the value from the LIC VX ATB.

It may be necessary to shut down the MPF and MPF PAS completely in the event of a major equipment or system failure. A shutdown of this type will be performed in strict accordance with the facility's standard operating procedures. Shutdown will be the reverse of the startup process that is described in Section 2.13, and subsystems will be shut down in the following order:

1. MPF PCC and AFB;
2. PAS; and then
3. Utilities.

Sampling will be stopped if a power failure occurs during a run. In addition, the waste feeds to the system will be stopped, but other operating parameters will be maintained to minimize emissions. The negative pressure in the MPF is maintained by the emergency ID fan, and the AFB is on essential power; therefore, during a power failure, one burner can be relit for complete combustion of the PCC exhaust gases.

5.13 INCINERATOR PERFORMANCE

Incinerator performance is discussed in this section as required by 40 CFR 270.62(a). TOCDF believes that the conditions specified in Section 5.3 for the trial burn will be adequate to meet the performance standards of 40 CFR 264.343 as incorporated into the TOCDF RCRA permit and the MACT regulations while processing mustard because:

- TOCDF experience burning Agents GB and VX in the MPF, under practically identical operating conditions to those described herein, shows that the expected DRE will exceed 99.99 %. In trial burn tests conducted at the Johnston Atoll Chemical Agent Disposal System (JACADS), a mustard agent DRE greater than 99.99 % was achieved.

- TOCDF experience burning chlorinated surrogates in the MPF, under similar operating conditions to those describe herein, suggests that the HCl and PM emissions will be less than their respective performance standards.

- The range of operating conditions planned for the ATB are within the design envelopes of the MPF and MPF PAS.

- The MPF and MPF PAS are tightly controlled by PLCs and AWFCOs whenever hazardous waste is being fed to the MPF.

- Two conditions with three runs each have been selected to demonstrate MPF operation. Temperatures are maintained within the parameters in Appendix D. Combustion airflow and velocity fluctuate as necessary to maintain the proper negative pressure in the MPF, and the fluctuations in metals and chlorine feed rates are minor. The operation of the PAS follows that of the MPF; hence, fluctuations in PAS operations are limited.

6.0 MUSTARD AGENT SHAKEDOWN PROCEDURES

The MPF has been processing metal items contaminated with Agents GB and VX since January 1997. Thus, all systems and startup testing has been performed. Once the approval of this ATB plan is received from the appropriate regulatory agencies, shakedown will commence as described in Section 6.2. During the shakedown period, the entire system will be thoroughly tested to verify that it performs in a safe, consistent, and predictable manner when processing mustard agent.

Shakedown testing will proceed in accordance with the TOCDF MPF Shakedown Plan (see Appendix B), which defines all activities, methodologies, shakedown criteria, and compliance actions associated with the testing of the system. As stated in the shakedown plan, operating conditions will be maintained within the envelope of anticipated final operating limits, defined in Appendix D, throughout the shakedown. These limits on operating conditions are based on good engineering practice, over nine years of experience with processing Agents GB and VX in the MPF, and feedback from the JACADS Mustard Agent Campaign. Operating limits will comply with the requirements of 40 CFR 270.62(a)(1). Proposed operating conditions are preliminary, and final values will be confirmed or modified as the shakedown progresses.

Hazardous wastes will not be fed to the system at any time unless the conditions discussed above are satisfied. The charging of munition trays to the incinerator will be stopped if operating conditions deviate from the established limits. The AWFCO system, described in Section 2.8, will be in operation at all times during the incineration of hazardous wastes. The AWFCO settings during the shakedown period are specified in Appendix D. Individual AWFCOs for those parameters that may cause total incinerator shutdown (i.e., auxiliary fuel, burners, ID fan) may be bypassed momentarily during routine calibrations when no waste is in the MPF.

A weekly report will be developed for DSHW to show the TCs processed, weights of heels in each TC based on the weight remaining after draining and the tare weight of the TC, heel depths measured in Area 10, and an estimated weight of solids based on the measured solid heel depth. This report will be submitted electronically.

6.1 STARTUP PROCEDURES AFTER AGENT CHANGEOVER

The systems will be heated until operating conditions have been reached, and temperatures will be held at operating conditions for 48 hr to verify that all systems are operating correctly. During that 48-hr period, operation of the PAS and CEMS will be verified, and the AWFCO system will be tested to verify that all the AWFCOs are operational. The DAQ and DSHW will be notified of the AWFCO test seven days in advance. The systems will then be declared ready for operation and the shakedown period will begin.

6.2 MUSTARD AGENT SHAKEDOWN

The objectives of the shakedown are to:

- Demonstrate that the MPF can safely and efficiently decontaminate mustard TCs at the proposed rate.

- Familiarize the operators with the differences in operations as a result of burning mustard agent.

- Verify that all systems function properly after Agent VX decontamination and changeover of any necessary equipment for mustard agent operations.

- Develop agent characterization data by collecting liquid mustard samples and solid heel samples from selected TCs. The liquid mustard agent samples will be taken from the discharge of the ACS tank once per week. Solid heel samples will be collected from 10 TCs that are representative of the TCs to be used in the MPF TC HD ATB.

- Evaluate the propriety of MPF conditions required for permit compliance.

During the shakedown phase, TOCDF will commence operations of all furnaces. In addition, TOCDF will provide DSHW with notice before introducing hazardous wastes into the system. Mustard agent will be introduced into the MPF in accordance with 40 CFR 264.344(c)(1) to bring the unit to a point of operational readiness for the trial burn. This phase will take 6 to 12 weeks and consist of up to 720 hr of agent processing.

The shakedown period involves a series of tests as described in the shakedown plan (see Appendix B). The shakedown will include monitoring of the POHC (mustard agent) using both ACAMS and DAAMS. TOCDF may request final modifications to the ATB plan based on data obtained during shakedown. If TOCDF deems changes to the trial burn plan are necessary, such changes will be coordinated with the DAQ and the DSHW.

The samples collected during the shakedown period will be used to verify the data collected during the Mustard Characterization Study, and to help establish metal feed rates. The shakedown samples will be analyzed for metals by the TOCDF CAL and results will be provided to state regulators when they become available.

6.3 POST-MUSTARD AGENT TRIAL BURN OPERATION

The interim period between completion of the trial burn and receipt of final approval of the trial burn report from DSHW could be several months. During this time, TOCDF intends to continue full-time operation of the MPF according to all federal requirements per 40 CFR 264, 266, and 270. During this period, TOCDF expects the MPF to operate within the operating envelope defined and demonstrated by the trial burn test. The feed rate for the MPF will be reduced to 50 % of the rate demonstrated during the trial burn. For TCs, the 50 % rate will be achieved by either doubling the charge time interval or draining the TCs to < 50 % of the demonstrated charge. Feed rates may be increased to 75 % of the rates demonstrated during the trial burn upon the State of Utah DEQ, Executive Secretary review of preliminary trial burn data. The feed rates will be increased to the demonstrated rate upon review of the Executive Summary of the ATB Report by the Executive Secretary.

The inspection plan will be followed, including visual inspection of the incinerator for fugitive emissions, leaks, and associated equipment spills and for signs of tampering, per 40 CFR 264.347(b). All appropriate operating records will document operating conditions.

The AWFCO system and associated alarms, as described in Section 2.8, will be functioning any time hazardous waste is in the combustion zone of the incinerator. The AWFCOs will be tested according to the established schedule. Test methods for the AWFCOs will remain unchanged from the methods specified in the RCRA and Title V permits.

6.4 INCINERATOR PERFORMANCE

TOCDF believes that the conditions specified in Section 6.0 for the startup, shakedown, trial burn, and post-trial-burn operation will be adequate to meet the performance standards specified in the TOCDF RCRA permit and the HWC MACT regulations while processing munitions containing mustard agent because:

- TOCDF experience treating munitions containing Agents GB and VX in the MPF, under operating conditions similar to those described herein, shows that the expected DRE will exceed 99.9999 %.

- TOCDF experience treating chlorinated surrogate materials in the MPF, under operating conditions similar to those described herein, suggests that the halogen emissions will be < 32 ppm, and the PM emissions concentrations will be < 29.7 mg/dscm. The estimated emissions are within the performance standards.

- TOCDF experience thermally treating Agent GB munitions and secondary wastes spiked with metals in the MPF resulted in metals emissions that did not pose a threat to human health or the environment, under operating conditions similar to those described herein.

- The range of operating conditions planned for the shakedown and post-trial-burn periods are within the design envelope of the MPF and MPF PAS (refer to Appendix C MEBs).

- The MPF and PAS will be tightly controlled by PLCs, and AWFCO systems will be operational at all times during the shakedown and post-trial-burn periods.

The MPF operating conditions for processing HD TCs will be protective of human health and the environment by meeting the performance standards and limiting metals emissions rates to values similar to the September 2003 DCD HHRA (see Table 5-5).

7.0 TRIAL BURN SUBSTITUTE SUBMISSIONS

This section is not applicable because an ATB will be conducted.

8.0 METAL PARTS FURNACE MUSTARD AGENT TRIAL BURN RESULTS

The results of the trial burn will be submitted in the report format specified in Appendix G. The key elements that will be included in each section of the trial burn report are:

- A summary of trial burn results describing any unusual process conditions (deviations from the approved trial burn plan) or difficulties experienced with sampling, testing, or analysis (Executive Summary).

- A discussion of any inconsistencies in the data and assessment of, and/or justification for, usability of the data (Executive Summary).

- A summary of conclusions in meeting the trial burn plan objectives (Executive Summary).

- A list of key project personnel by functional position (Section 1.0).

- A comparison of test conditions to planned conditions for all waste feed rate information, waste generation rate information, and MPF PAS exhaust gas parameter rate information, including at a minimum (Section 3.0):
  - Maximum, minimum, average, and standard deviation of the mustard agent feed rates.
  - Maximum, minimum, average, and standard deviation of combustion chamber temperatures.
  - Maximum, minimum, average, and standard deviation of PAS operating conditions.
  - Maximum, minimum, average, and standard deviation of exhaust gas velocity.
  - Exhaust gas concentrations of O_2, CO, and CO_2.

- A description of mustard agent sampling and analyses results including exhaust gas concentrations and the calculation of the DRE for mustard (Section 4.0).

- A summary of test results and a comparison with permit or regulatory compliance limits, including (Section 5.0):
  - Analytical results; and
  - Exhaust gas concentrations and exhaust gas emission rates (pounds per hour) of metals, HF, HCl, Cl_2, PM, PCDDs and PCDFs, PICs, SO_2, NO_x, and THCs.

- A description of sampling methods, sample preparation, and analytical procedures for process samples (Section 6.0).

- Example Calculations for key data (Appendix A).

- An exhaust gas sampling report including sampling equipment calibration data (Appendix B).

- PDARS data (Appendix C).

- CEMS data (Appendix D).

- A Quality Assurance (QA)/(QC) report, including a key that relates the laboratory sample identification numbers to trial burn sample identification numbers and QC Criteria performance (Appendix E).

- Mustard agent characterization data (Appendix F).

- Mustard agent analyses by ACAMS and DAAMS (Appendix G).

- Field GC VTOC data (Appendix H).

- Sampling method for Volatile Organic Compounds (SMVOC) analytical data (Appendix I).

- Analytical data for process samples and emission samples (Appendix J).

Complete data will be submitted for all analyses conducted, including the data from failed runs.

TOCDF will submit the trial burn report within 90 days after completion of the trial burn. The trial burn report will be certified in accordance with the requirements of 40 CFR 270.62(b)(7-9).

9.0 FINAL OPERATING LIMITS

The ATB demonstration of DRE, mustard agent feed rates, metals emissions, PM emissions, halogen emissions, and PIC emissions will be used to establish the operating permit limits for the MPF. The successful completion of the MPF TC HD ATB will establish the operating permit at the levels discussed in this section.

The destruction of organic compounds is a function of time, temperature, and turbulence. The combustion temperatures and gas velocities in the system demonstrate operating conditions that ensure the destruction of organic compounds and avoid PIC formation. The waste feed rates demonstrated during the MPF TC HD ATB will present the maximum challenge for PM loading to the MPF PAS. The pH of the Brine in the PAS will control the emission of acid gases (SO_2 and HCl) present in the exhaust gas.

The anticipated final operating conditions resulting from the trial burn are summarized in Appendix D. These data were prepared following the hierarchy of process-control-related performance parameters, as established by EPA Guidance (5). Each anticipated MPF final operating limitation is listed by process parameter, target value during the trial burn, and anticipated manner in which the limit will be established. In accordance with EPA guidance, the process parameters presented in Appendix D are broken down by Group A, B, and C parameters, as follows:

- Group A - These parameters will be monitored continuously and will be connected to an AWFCO system. When a Group A parameter is exceeded, contaminated waste feed must be discontinued immediately. Group A parameters will be established based on the operating conditions demonstrated during the trial burn.

- Group B - These parameters will not be monitored continuously. Compliance with these parameters will be based on operating records to ensure that routine operation is within the operational limits established by the trial burn.

- Group C - Limits on these parameters will be set independently of trial-burn-demonstrated parameters. Instead, these limits will be based on EPA guidance, equipment manufacturer design and operating specifications, operational safety considerations, and good engineering practices. Group C parameters are monitored both continuously and periodically. Depending upon the particular Group C parameter, it may or may not be an AWFCO parameter.

9.1 GROUP A PARAMETERS

Group A parameters include:

- Maximum mustard agent feed rate, as measured by the amount of mustard agent per charge and charge frequency that was demonstrated during the MPF TC HD ATB.

- Minimum PCC zone temperature, which is related to meeting the DRE, metal emissions, and to thermally decontaminating materials processed through the furnace. The final approved permit limit for minimum PCC zone temperature will be established per the regulation of 40 CFR 63.1209.

- Minimum AFB temperature, which is related to DRE and metal emissions. Provided that satisfactory DRE results are obtained for mustard agent, the final approved permit limit for minimum AFB temperature will be established per the regulation of 40 CFR 63.1209.

- Maximum Exhaust Gas Velocity (measured as V-Cone® ΔP), which is related to DRE and gas treatment based on the demonstrated exhaust gas flow. Gas velocity in the MPF exhaust duct is an indicator of exhaust gas residence time in the AFB. Provided that satisfactory DRE results are obtained for mustard agent during the ATB, the final approved operating condition will be established per the regulation of 40 CFR 63.1209.

- Minimum Brine flow to the venturi scrubber, which is related to particulate emissions. Provided that acceptable particulate emission results are obtained during the ATB, the final approved permit limit for minimum Brine flow to the venturi scrubber will be established per the regulation of 40 CFR 63.1209.

- Minimum venturi scrubber differential pressure, which is related to metals emissions and PM emissions. The permit limit for minimum venturi scrubber differential pressure to the venturi scrubber will be established per the regulation of 40 CFR 63.1209, provided the ATB demonstrates acceptable metals emissions and PM concentrations of < 29.7 mg/dscm.

- Minimum venturi scrubber Brine pH, which is related to HCl and SO_2 emissions. The minimum venturi scrubber Brine pH will be established per the regulation of 40 CFR 63.1209, provided that adequate HCl and SO_2 controls have been demonstrated during the MPF TC HD ATB.

- Maximum quench Brine density, which is a specific gravity demonstrated during the ATB and averaged over a 12-hour period. Experience has shown that if the Brine becomes too dense due to the salts in solution, nozzles may clog and piping may become plugged.

- Minimum clean liquor flow rate, which is related to HCl and SO_2 emissions. The minimum clean liquor to scrubber tower flow rate will be the value established per the regulation of 40 CFR 63.1209, provided that adequate HCl and SO_2 controls have been demonstrated during the MPF TC HD ATB.

9.2 GROUP B PARAMETERS

Group B parameters based on the MPF TC HD ATB include:

- A POHC DRE of 99.9999 % (99.99 % if the heel is < 90 lb) or greater for mustard agent, which will be demonstrated by Condition 1 of the MPF TC HD ATB. This DRE demonstration will allow TOCDF to process the agent contained in the munitions in the DCD Stockpile. For purposes of this ATB, agent will include mustard agent and the organic impurities found in the munitions.

- Maximum hazardous waste feed rates, which are the combination of mustard charge weights up to the maximum demonstrated during the ATB and the demonstrated charge interval. Each condition will be performed as close to the maximum mustard charge rates as possible. The final approved permit limit for container feed will be these maximum waste feed rates, providing that an agent DRE of at least 99.9999 % (99.99 % if the heel is < 90 lb) is achieved during each run. The waste feed rate limit for miscellaneous waste will remain as currently permitted because the quantity of agent potentially processed in miscellaneous wastes is so low compared to container heels demonstrated in this ATB.

- Maximum metals feed limits, which will require that metals be measured during each run, with the results compared to the overall risk factors used in the HHRA. TOCDF expects to meet these limits while processing at trial burn rates. Thus, the trial burn will be considered an acceptable metals test for all mustard-contaminated containers.

- Maximum ash feed limits, which will require the PM emissions be measured during each run. If the particulate emissions are ≤ 29.7 mg/dscm, the trial burn will be considered an acceptable particulate test for all mustard-contaminated containers.

- Maximum chlorine feed limits, which will require the halogen emissions be measured during each run. If the halogen emissions are ≤ 32 ppm, the ATB will be considered an acceptable chlorine feed rate test for mustard-contaminated containers.

- Maximum PCDD/PCDF emissions, which have an expected permit condition of 0.4 ng/dscm 2,3,7,8-TCDD TEQ corrected to 7 % O_2. This parameter is controlled by the mustard charge weight and charge interval and minimum MPF temperatures.

9.3 GROUP C PARAMETERS

Establishment of Group C parameters include:

- CEMS operation, which will comply with the EPA guidance stating that CEMS must be operational when the MPF is processing wastes. A loss of instrument signal from both CO monitors or both O_2 monitors will result in an AWFCO.

- Maximum PCC pressure, which is based on EPA guidance for fugitive emissions control. Fugitive emissions control will be a qualitative demonstration. Maintaining the pressure in the MPF PCC slightly below atmospheric pressure will control fugitive emissions from the incinerator. A PCC pressure > -0.1 inWC for one minute (as described in the AMR in Appendix F) will be the AWFCO limit, and it will be in effect during the MPF TC HD ATB. When the MPF PCC pressure exceeds the maximum pressure limit, all feed to the MPF stops automatically.

- Maximum quench tower exhaust gas temperature, which is based on the manufacturer's recommendations. The maximum temperature limit proposed for quench duct exit temperature will be 225 °F to protect temperature-sensitive construction materials in the remainder of the PAS. When the quench tower duct exit temperature exceeds the maximum limit, all waste feeds are stopped.

- Minimum heating value, TOCDF sees no reason for specifying minimum heating value permit conditions for the MPF since the main purpose of the MPF is to thermally decontaminate munitions and other metal parts with no heating value.

- Minimum quench Brine pressure, which is related to metals emissions and PM emissions. The final approved permit limit for minimum quench Brine pressure should remain 70 psig as the Manufacturer's Recommendation, provided that the MPF TC HD ATB demonstrates acceptable metals emissions and PM concentrations of < 29.7 mg/dscm.

- Minimum clean liquor pressure, which is related to HCl and SO_2 emissions. The final approved permit limit for minimum clean liquor pressure should remain at 25 psig as the Manufacturer's Recommendation, provided that adequate HCl and SO_2 controls are demonstrated during the ATB.

- Maximum CO concentration at the blower exhaust, which is related to PIC control with a performance standard of 100 ppmdv as an HRA corrected to 7 % O_2. Waste feeds will not be resumed until the HRA concentration falls below the 100-ppmdv HRA limit as described in Section 2.9.1.1. The final approved permit limit for the HRA CO concentration should remain at 100 ppmdv corrected to 7 % O_2, dry volume, provided that acceptable PIC control is demonstrated during the ATB.

- Minimum and maximum O_2 concentrations at the blower exhaust, which is related to MPF operation under oxidative operating conditions to treat the waste feeds. The O_2 concentrations in the combustion system are controlled to remain in the range of 3 % to 15 % at the blower exhaust. The final approved O_2 permit limits will remain 3% to 15%, provided that DRE and PIC levels are satisfactory and no confirmed agent alarms are received during the ATB.

- Maximum thermal input to the PCC, which is the upper limit of 15.7 million Btu/hr, based on the Manufacturer's Recommendation.

- Maximum PCC zone temperature, which is related to the Manufacturer's Recommendation. Provided that the ATB metals emissions meet the overall risk factors used in the HHRA, the final approved permit limit for maximum PCC zone temperature will be the Extreme Temperature Limit (ETL).

- Maximum thermal input to the AFB, which is the upper limit of 8.5 million Btu/hr, based on the Manufacturer's Recommendation.

- Maximum AFB temperature, which is related to the Manufacturer's Recommendation. Provided that the ATB metals emissions meet the overall risk calculated by the HHRA, the final approved permit limit for maximum AFB temperature will be the ETL value.

- Minimum capacity of the Brine surge tanks, which is the high-high level of 18 ft 3 inches. To ensure that there is volume to receive drainage from the PAS if density or levels become unacceptable, an AWFCO will result if all four Brine surge tanks reach the high-high level.

- Maximum agent stack concentration, which is the setpoint noted in Appendix D. Scientific research has determined the maximum SEL for each agent to ensure that there is no threat to workers or the general public. The ACAMS would initiate an AFWCO should stack concentrations exceed the setpoint. Agents GB and VX will also be monitored at the common stack with their AWFCO as listed in Appendix D.

- Maximum agent duct concentration, which is the setpoint listed in Appendix D. Scientific research has determined the maximum SEL for each agent to ensure that there is no threat to workers or the general public. Two staggered ACAMS would initiate an AFWCO should MPF Duct mustard agent concentrations exceed the setpoint shown in Appendix D.

10.0 REFERENCES

(1) ***Test Methods for Evaluating Solid Waste, Physical/Chemical Methods***, 3rd Edition, including Update III, USEPA, SW-846, December 1996.

(2) Title 40, ***Code of Federal Regulations***, Part 60, Appendix A, "Test Methods."

(3) **Attachment 20 to the TOCDF Permit, *CEMS Monitoring Plan***, EG&G Defense Materials, Inc., TOCDF **CDRL-06**.

(4) ***Hazardous Waste Combustion Unit Permitting Manual***, Component 1, "How to Review a Trial Burn Plan," U.S. EPA Region 6, Center for Combustion Science and Engineering, 1998.

(5) ***Guidance on Setting Permit Conditions and Reporting Trial Burn Results***, EPA/625/6-89/019, January 1989.

(6) ***Guidance for Total Organics***, Final Report, EPA/600/R-96-036, March 1996.

(7) **Attachment 22 to the TOCDF Permit, *Agent Monitoring Plan***, EG&G Defense Materials, Inc., TOCDF CDRL 23.

(8) Title 40, ***Code of Federal Regulations***, Part 60, Appendix B, Specification 4B "Standards of Performance for New Stationary Sources."

(9) Title 40, ***Code of Federal Regulations***, Part 60, Appendix B, "Performance Specifications."

(10) "Standard Practices for Sampling Water from Closed Conduits," ***ASTM D 3370-95a*** (Re-approved 1999), ASTM International, West Conshohocken, Pennsylvania.

(11) "Standard Practice for Sampling with a Scoop," ***ASTM D 5633-94***, ASTM International, West Conshohocken, Pennsylvania.

(12) ***Mustard Characterization Project Report for Deseret Chemical Depot Mustard Ton Containers***, Revision 0, EG&G Defense Materials, Inc., January 14, 2004.

(13) ***Mustard Sampling Validation Project Report***, Revision 0, EG&G Defense Materials, Inc., January 2005.

(14) ***RCRA Waste Sampling Draft Technical Guidance***, United States Environmental Protection Agency, EPA530-D-02-002, August 2002.